PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
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X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21:548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0:536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page* 3 *of cover*

MATHEMATICS 51

1 : 531.51 : 530.12 *see Abstr.* 1764

12.2 : 518.5 = 3 *see Abstr.* 1733

1732

nstruction of alignment nomogram from empirical Lo-Ho. *J. Franklin Inst.*, **245**, 227–44 (*March*,).

1 : 517.512.2 = 3 1733

alysis of oscillations by the projection periodograph. ER-EPPLER, W. *Z. InstrumKde*, **63**, 341–55 (*Oct.*,) *In German.*—Deals with the practical application of ojection periodograph [Abstr. 2992 (1942)], which is nstrument for Fourier and frequency analysis of empirical functions. The curve to be investigated is cut out of paper and placed on a celluloid strip, or alternatively recorded like a sound film track. The phase and frequency of the component oscillations of the function under test are found by means of interference patterns produced on a ground glass screen or photographic plate. The properties of periodographs are explained by 2 practical applications, and possible sources of error enumerated. V. W. R.

518.5 : 621.317.39 = 5 1734

An electrical method for determining approximately the real or complex roots of an algebraic equation. BORSELLINO, A. *Nuovo Cim.*, **5**, 23–8 (*Feb.*, 1948) *In Italian.*

ASTRONOMY . ASTROPHYSICS . GEODESY 52

98 : 529.71 1735

rors of time determination. SYMMS, L. S. T., AND NY, C. J. A. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 5) 405 (1946).—A strong correlation between clock rs and collimation errors on a standard transit circle cates that much of the day-to-day scatter of clock r is due to accidental error in the measurement of mation. Much of a given observer's personal ation is also found to arise from his collimation sures. The effect of level error is also discussed. For Edinburgh transit circle, the overall probable error of ne determination from 10 stars is ± 32 msec, reduced ± 20 msec by applying corrections for personal ation. That part of the probable error not due to ors in measuring collimation or level is ± 10 msec.

A. HU.

: 621.397.82 1736

olar noise. DREWE, E. C., AND MAURICE, D. *Nature*, *id.*, **161**, 167 (*Jan.* 31, 1948).—[Abstr. 1609 B (1948)].

.11 : 523.877 1737

he synthesis of the elements from hydrogen. HOYLE, F. *n. Not. R. Astr. Soc.*, **106** (*No.* 5) 343–83 (1946).—naustion of a star's supply of H for thermonuclear ctions leads to collapse which, if the mass exceeds a ical value, continues until rotational instability occurs. tter is then ejected until the mass falls to the critical ue, when the star attains equilibrium as a white dwarf. e temperature generated during collapse is sufficiently h for statistical equilibrium to be attained between the ments. The equations of statistical mechanics thus ply; they are deduced and predict relative abundances ich are uniform to within a factor of 10^6 along the riodic table. The heavy elements are distributed in erstellar space by rotational ejection. Certain initial nditions lead to a particular catastrophic collapse ich is identified with a supernova outburst. A. HU.

3.11 : 537.591 1738

Milne's cosmology and the origin of cosmic rays. ORGE, E. P. *Phil. Mag.*, **39**, 240–3 (*March*, 1948).—n the basis of Milne's theory an explicit expression is tained for the energy spectrum of primary particles tering the earth's atmosphere. If $n(E)$ is the number such particles in the energy range $(E, E + dE)$, then $E) \simeq \text{const.}/E^3$, for $E \gg m_0c^2$. This compares favourly with experiment. L. S. G.

23.152.2 1739

On some possible evolutionary trends in the interstellar edium. THACKERAY, A. D. *Observatory*, **68**, 22–6 *Feb.*, 1948).—Collisional evaporation at the fringes of interstellar clouds will prevent the complete use of all interstellar gas in particle-building processes, and the clouds themselves will sweep up 7% of their own mass in 10^6 yr. High-luminosity stars are so rare that dispersal by radiation pressure will not counterbalance this, so the process of cloud-building will go on faster than star-building by accretion. The most favourable conditions for particle growth are expected near the galactic centre, but away from the giants in the galactic plane, i.e. where globular clusters (but no interstellar clouds) are observed. The continuous ejection of matter from novae and other supergiants replenishes the interstellar medium relatively quickly. A. HU.

523.165 : 537.591 1740

Note on the origin of cosmic rays. HOYLE, F. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 5) 384–9 (1946).—Exceptional cases of rotational instability in stars [Abstr. 1737 (1948)] may lead to the ejection of matter of density 10^{14} g/cm^3 at a velocity comparable with that of light. Electric potentials built up in this matter by a process akin to that in thunderstorms may accelerate protons and other nuclei to the very high speeds required of cosmic-ray particles. The observed intensity of cosmic rays can be produced by such a process. Other possible similar processes are indicated. A. HU.

523.2 1741

On the condensation of the planets. HOYLE, F. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 5) 406–22 (1946).—A gaseous disc moving orbitally about the sun is shown to form solid particles, initially by condensation from the supersaturated vapours of metals and oxides. This process gives masses of order 10^{23} g in about 10^8 yr. Thence in another 10^8 yr, accretion increases the mass to 10^{30} g. The speed of the final stage of growth by accretion indicates that the first few particles to reach 10^{28} g will rapidly acquire the rest of the material. Thus a few large planets will be formed, only a small fraction remaining as the asteroids. The terrestrial planets probably originated in rotational instability of primitive bodies of mass about that of the present major planets. These are to be expected to possess the required rapid rotation. A. HU.

523.323.6 : 523.982 : 523.72 = 4 1742

Photometric theory of the penumbra during eclipses of the moon. LINK, F. *Čas. Pěst. Mat. Fys.*, **72** (*No.* 2) 65–77 (1947) *In French.*—Gives a comparison between photometric observations made at 10 lunar eclipses and values derived theoretically. A difference is found, which is interpreted as due to the luminescence of the lunar surface by ultraviolet rays from the lower atmo-

sphere of the sun. It is suggested that it will be possible to study the variations of solar u.v. emission by direct measures. E. G. M.

523.4 : 530.12 *see Abstr.* 1762

523.5 : 621.396.9 1743

Reflections of very-high-frequency radio waves from meteoric ionization. ALLEN, E. W., JR. *Proc. Inst. Radio Engrs, N.Y.*, **36**, 346–52 (*March*, 1948).—The reflection of v.h.f. waves by ionization, produced by the passage of meteors through the upper atmosphere, results in echoes of short duration. For frequencies between 40 and 50 Mc/s, the duration is usually $\geq$ a few tenths of a second, although infrequently one of several seconds duration is observed. The characteristics of the echoes as determined by measurements are discussed, and correlations shown between the distributions of occurrence and the theoretical and observed distributions of meteors. The observations indicate that the reflection cannot be treated as specular, but that the reflected waves form a lobe in the direction of the reflected ray which would exist if the reflection were specular. A.

523.61 : 523.745 = 4 1744

Influence of solar activity on the number of comet discoveries. LINK, F., AND VANÝSEK, V. *C.R. Acad. Sci., Paris*, **225**, 1284–5 (*Dec.* 22, 1947) *In French.*—A short preliminary comparison (covering 9 sunspot cycles, 1844–1944) of the number of observed comets with newly discovered minor planets, frequency of sunspots and rainfall. A flat max. of rainfall appears near sunspot max., where the comet discoveries show a flat min. This would indicate the influence of observing conditions; minor planets, however, show no such relation, and the authors suggest another explanation based on the direct effect of solar radiation on the brightness of comets. A. B.

523.63 1745

The short-periodic comets and the hypothesis of their capture by the major planets. STRÖMGREN, E. *K. Danske Vidensk. Selsk. Mat.-fys. Medd.*, **24** (*No.* 5) 10 *pp.* (1947).—Tabulates the orbits of 78 comets observed in one or more apparitions. Data for the Jupiter group confirm the conditions: i small and/or ω close to 0° or 180°. R. A. N.

523.72 1746

Solar radiation in the radio spectrum. I. Radiation from the quiet sun. MARTYN, D. F. *Proc. Roy. Soc. A*, **193**, 44–59 (*April* 22, 1948).—The theory of the emission of thermal radiation from the solar envelope at radio-frequencies is worked out in detail. The Lorentz theory of absorption is used in conjunction with Kirchhoff's law to derive the effective temperature of the various regions of the solar disc over the radio spectrum. A maximum effective temperature approaching 10^6 °C is found in the vicinity of 1-m wavelength. Limb brightening occurs at cm-wavelengths. It is shown that Gaunt's quantum mechanical expression for free-free emission yields results almost identical with the classical treatment, provided Chapman and Cowling's expression for the collision frequency in a fully ionized gas is used in the latter treatment. It is suggested that it may be preferable to treat problems of solar and galactic radio noise by classical methods, particularly when the refractive index of the medium departs appreciably from unity. A.

523.72 = 3 1747

The radiofrequency radiation of the solar corona. WALDMEIER, M. *Experientia*, **4** (*No.* 2) 64–6 (1948) *In German.*—The intensity of the radio frequencies emitted by the sun is calculated from the "free-free transitions" theory of the electrons in the solar corona. For wav lengths < 1 m there is an abrupt increase at the sur limb. The spectral distribution up to wavelength of 5 is given for points at distances 0, 1 and 2 radii from t centre of the disc. G.

523.72 : 523.982 : 523.323.6 = 4 *see Abstr.* 1742

523.72 : 538.566.2 17

On the conditions of escape of microwaves of radi frequency range from the sun. SAHA, M. N., BANERJE B. K., AND GUHA, U. C. *Indian J. Phys.*, **30**, 199–2 (*Oct.*, 1947).—A discussion based on magneto-ion theories of propagation in an ionized medium in magnetic field. A general and satisfactory explanation given of all the facts observed so far.

523.743 : 523.755 17

On noise arising from the solar granulation. SCHWAR SCHILD, M. *Astrophys. J.*, **107**, 1–5 (*Jan.*, 1948). Kinetic energy is brought by solar granulations to the t of the convective zone at the rate of 10^{30} erg/sec, mo than sufficient to maintain the observed temperatures the corona and chromosphere, where the rate of heat lo is $< 10^{26}$ erg/sec. A steady stream of acoustical wav originating in the turbulent motions of the granules postulated to transport mechanical energy through t photosphere (leaving it in dynamical and therm dynamical equilibrium) and to dissipate it in the sun outer layers. A. H

523.745 : 523.61 = 4 *see Abstr.* 1744

523.746 175

Alfvén's theory of sunspots. COWLING, T. G. *Mo Not. R. Astr. Soc.*, **106** (*No.* 5) 446–56 (1946).—Th theory [Abstr. 3013 (1947)] is shown to be inconsiste internally and with observation at a number of point If the magnetic field causes the spot's darkness, the ba must be at too great a depth. The behaviour of magnet hydrodynamic waves near the surface is open to doub and they should not produce dark spots, particularly wi the observed properties of sunspots. A. H

523.746 17

Sunspot groups of irregular magnetic polarit RICHARDSON, R. S. *Astrophys. J.*, **107**, 78–93 (*Ja* 1948).—Statistical investigations of 7 890 sunspot grou (observed at Mount Wilson during three cycles, 1917–4 were carried out to determine the properties of irregul magnetic polarity. Of the total, 9% were unipolar spo and 91% bipolar; 3% of the latter were irregular, i. failed to conform to the laws governing the arrangeme of polarities in the northern and southern solar hem spheres. Apart from their magnetic behaviour, the irregular groups revealed hardly any differences in oth respects from ordinary bipolar groups (statistics change in mean latitude and frequency during one cycl strength in magnetic field; Wilson and Evershed effects They may be, however, rather smaller and less stabl and their axes are perhaps more inclined to the sola equator. A. I

523.752 175

A working hypothesis of solar flares. EVANS, D. S *Observatory*, **67**, 218–23 (*Dec.*, 1947).—Analogies ar drawn between flares and terrestrial tornadoes an between sunspots and ordinary depressions. Sola material from great depths is supposed to be sucked t the surface, where it appears as a short-lived brigh flocculus. The hypothesis explains the motions observe in associated surge prominences, and the ejection o charged particles later detected by their terrestrial effect (aurorae, etc.). The Pannekoek–Rosseland field wil produce a sensible density of moving charge and henc

appreciable magnetic field whose electromagnetic ts may exceed solar gravity. Observational tests of ypothesis are suggested. A. HU.

755 : 523.743 *see Abstr.* 1749

342 : 531.5 : 523.877 1753

e decay of the gravitational energy of a double star. K, G. L. *Mon. Not. R. Astr. Soc.*, **106** (*No.* 5) 53 (1946).—The method of a previous paper [Abstr. 1941)] in discussing a rotating rod is used to derive oss of gravitational energy of a double star. The tion is of the same order of magnitude as for sive systems. A. HU.

352.3 : 530.12 = 4 1754

e recession of the extra-galactic nebulae. DRUMAUX, *Ann. Soc. Sci. Brux.*, **61** (*Sér. I*) 228–34 (*Dec.* 12,); **62** (*Sér. I*) 27–35 (*March* 3, 1948) *In French.*—In r work [Abstr. 2009 (1947)], nebula velocities have represented as a linear vector function $a_{\mu\nu}x^{\nu}$ of radius vector x^{ν} relative to the galaxy. It is now n that when the cubic $|a_{\mu\nu} - k\delta_{\mu\nu}| = 0$ has one root, nebulae move in screw motions whose pro- ons are elliptic spirals. The case of three real roots so discussed. It is concluded that the transverse on will be periodic or aperiodic according as the ession is large or small. R. A. N.

372 : 539.155.2 = 4 1755

otopes of carbon and nitrogen in stars of class R and DAUDIN, A., AND FEHRENBACH, C. *C.R. Acad. Sci.*, , **225,** 1127–9 (*Dec.* 10, 1947) *In French.*—Analysis of tra confirms existence of C^{13}. Certain details of spectra are attributed to N^{15}. R. A. N.

375 1756

ne blue-white sequence. VORONTSOV-VELYAMINOV, B. *ervatory*, **67,** 224–6 (*Dec.*, 1947).—Estimates of the metric luminosities of the ordinary blue dwarfs est that they form a continuous sequence with rrent novae. It is suggested that the hottest giants, by repeated outbursts with diminishing frequency and increasing amplitude, lose mass and luminosity, becoming the blue and white dwarfs. A. HU.

523.877 = 4 1757

On the solution of the problem of model atmospheres when the coefficient of absorption is an arbitrary function of frequency. KOURGANOFF, V. *C.R. Acad. Sci., Paris*, **225,** 1124–6 (*Dec.* 10, 1947) *In French.*—Outlines a formal procedure which combines an earlier variational method [Abstr. 19 (1948)] with iteration. R. A. N.

523.877 : 523.11 *see Abstr.* 1737

523.877 : 531.5 : 523.842 *see Abstr.* 1753

523.877 : 539.17 = 4 1758

Nuclear reactions at high densities. SCHATZMAN, E. *C.R. Acad. Sci., Paris*, **225,** 867–9 (*Nov.* 10, 1947) *In French.*—It is shown that when a stellar density is sufficiently great, the rate of nuclear reactions is no longer $\propto$ (density)^2. The nuclear potential barriers become effectively thinner because of increasing electron density, and this may increase the reaction probability by many orders of magnitude. A. P. F.

523.982 : 523.72 : 523.323.6 = 4 *see Abstr.* 1742

525.721 : 621.396.11 : 551.510.535 = 4 *see Abstr.* 1949

525.73 : 535.8 *see Abstr.* 1831

526.918.5 : 535.317 : 535.8 *see Abstr.* 1832

529.71 : 522.98 *see Abstr.* 1735

529.78 : 531.53 = 4 1759

On the conical pendulum. HAAG, J. *C.R. Acad. Sci., Paris*, **225,** 1234–6 (*Dec.* 22, 1947) *In French.*—The conical pendulum used as a regulator of clocks and chronometers has the advantage of providing a continuous measure of time. But from consideration of stability of steady motion an estimate of possible error amounting to almost 2 sec/day is obtained. This proves the conical pendulum to be inferior to the ordinary pendulum as a precision regulator. G. G.

PHYSICS 53

385.2 : 621.3.088.2 = 5 1760

rors in precision measurements—classification and inology. TORZO, G. *Elettrotecnica*, **32,** 1 (*Jan.* 5, 1945). *Pubbl. Ist. Elettrotec. Naz. Galileo Ferraris* 177) *In Italian.*—The lack of precision in common inology is criticized and clear definitions are given oncepts in measuring-technique, such as arithmetic algebraic value as distinct from abs. and rel. value, rtainty as distinct from error. Causes of errors are ified, sensitivity and other characteristics are dis- ed, the error function is considered in detail, and the ssment of the combined effect of all imprecisions is t with. The procedure of precision measurement on standard cells of the Ist. Elettrotec. Naz. Galileo aris is described as an illustration. J. A. W.

388.21 : 612.84 *see Abstr.* 1970

FUNDAMENTALS 530.1

12 1761

he final affine field laws. II–III. SCHRÖDINGER, E. *. R. Irish Acad.*, **51 A** (*No.* 16) 205–16; **52 A** (*No.* 1) (*Feb.*, 1948).—[Part I, Abstr. 26 (1948)]. In Part II, ied field theories are surveyed which are derivable n a variational principle $\delta I = \delta\int\sqrt{(-g)}\,\frac{1}{2}g^{kl}R_{kl}d\tau = 0$, re R_{kl} is the Ricci-tensor of an affine connection and the $\sqrt{(-g)}\,\frac{1}{2}g^{kl}$ represent a contravariant tensor- sity. The different theories arise according as, in performing the variation, the g_{kl} (covariant form of the g^{kl}), or the Γ^{i}_{kl}, or both, are regarded as independent variables; and further, according as one, both, or neither of the g_{kl} and Γ^{i}_{kl} are regarded as symmetric. Eight types of theory result and the differential field-equations are derived for seven of them, the eighth (g_{kl} asymmetric and only the g_{kl} independent variables) being dismissed *a priori*. In Part III conservation-laws and expressions for the stress-energy-momentum are found. No attempt is made to solve any of the field-equations and so to check the theoretical predictions with any observational or experimental data. G. C. McV.

530.12 : 523.4 1762

The relativity effect in planetary motions. CLEMENCE, G. M. *Rev. Mod. Phys.*, **19,** 361–4 (*Oct.*, 1947).—The author outlines his thorough re-discussion of the motion of the perihelia of mercury and of the earth, and finds that the agreement with the relativity effect is satisfactory. H. B.

530.12 : 523.852.3 = 4 *see Abstr.* 1754

530.12 : 531.18 : 535.1 *see Abstr.* 1794

530.12 : 531.51 1763

Gravitational metrics of spherical symmetry and class one. KARMARKAR, K. R. *Proc. Indian Acad. Sci. A*, **27,** 56–60 (*Jan.*, 1948).—Generally, every gravitational metric of spherical symmetry is of class 2 but the condition for the metric to be of class 1 has been obtained

in several forms; the limitations which the condition imposes on possible perfect fluid distributions is discussed. W. R. A.

530.12 : 531.51 : 513.81 1764

Einstein's theory of gravitation and flat space. PAPAPETROU, A. *Proc. R. Irish Acad.*, **52 A**, 11–23 (*March*, 1948).—The author discusses the difficulties associated with the concept of angular momentum in general relativity, and shows that satisfactory definitions and conservation laws exist if one uses the flat space background introduced by Rosen [Abstr. 640 (1940)]. Several relations are established, but no attempt is made to give any physical meaning to the flat space background. H. B.

530.12 : 537.123 : 537.591 1765

Production and annihilation of negative protons. II. MCCONNELL, J. *Proc. R. Irish Acad.*, **51 A**, 173–90 (*Oct.*, 1947).—An extension of previous work [Abstr. 785 (1946)]. The production of negative protons by the collision of 2 charged mesons is studied, the M–R meson theory [Abstr. 740 (1947)] being taken. The rate of production is smaller than obtained formerly, where account was taken only of pseudoscalar mesons, but the order of magnitude of the process is the same. Production by meson-nucleon collisions is discussed; the process only occurs when energy of the meson is at least 4×10^9 eV. With increasing energy the value of the cross-section rises rapidly from zero to a max. value of $3\cdot5\times10^{-29}$ cm^2 for an energy of 2×10^{10} eV, and then slowly decreases to an asymptotic value of 3×10^{-29} cm^2. The possibility of detecting negative protons in cosmic ray experiments is discussed. L. S. G.

530.14 = 5 1766

On the isobaric states of the nucleon in the deuton problem. KIND, A. *Nuovo Cim.*, **5**, 1–22 (*Feb.*, 1948) *In Italian.*—In order to verify Villars' results [Abstr. 1720 (1947)], the problem of the deuteron ground state is studied here by a method which permits the exact determination of the error limit. The model used involves the essential features of meson theory, but disregards details. The potentials of the isotropic and tensorial interactions are replaced by square well potentials of depths V and U and range $r_0 = 2\cdot8\times10^{-13}$ cm, which are calculated from the binding energy E and the electrical quadrupole moment Q of the ground state, for two values of the isobar excitation energy. The deuteron ground state is a mixture of one ^3S component F_0 without isobar excitation and an infinite number of components F_m of the type ^3S, ^3D, ^7D,..., where the nucleons are in different isobar excitation states. The problem is simplified by considering only the component F_0 and the four components F_m, which are directly coupled with F_0. It appears that the errors involved in Villars' method have no essential importance in the problem under consideration, and one can therefore conclude that his general results are correct. A.

530.14 = 5 1767

On the motion of a Dirac particle in a mixed Coulomb field. CALDIROLA, P. *Nuovo Cim.*, **5**, 29–35 (*Feb.*, 1948) *In Italian.*—For a Dirac particle, Furry has given an approximate formula which is valid up to terms of the order v^2/c^2. This formula, permitting the calculation of nuclear level separations produced by the spin orbit coupling, shows that relativistic corrections depend in a very sensitive way on the character of the field of force with regard to a Lorentz transformation. In order to show the different behaviour of the scalar and vectorial forces, the exact solution of the Dirac equation is calculated for a particle subject to simultaneous action of a vectorial Coulomb field and of a scalar Coulomb field. The exact eigen-values and those neglecting terms of the order of the fine structure constant are given. Using this formula, the dependence of the fine structure of the levels on the percentage of the two types of field is discussed. A.

530.145 176

Observable magnitudes in the theory of elementary particles. III. HEISENBERG, W. *Z. Phys.*, **123** (*Nos.* 1–2, 93–112 (1944) *In German.*—Extends Heisenberg's η-matrix theory of elementary particles [Abstr. 2109 (1944)] and shows that it is applicable to stationary states as well as impacts and scattering. A model system of elementary particles, including particles without charge or spin, is investigated. The η-matrix fully describes all observable properties of these elementary particles. The usual wave equations are investigated with a view to converting them to integral equations and harmonizing them with the quantum theory. The integral equations remove the previous difficulties with the usual theories. V. W. R

530.145 : 537.133 176

On the reactive terms in quantum electrodynamics. LEWIS, H. W. *Phys. Rev.*, **73**, 173–6 (*Jan.* 15, 1948).—Many of the divergent terms in the relativistic calculation by Dancoff [Abstr. 3010 (1939)] on the radiative scattering of electrons, which are not associated with terms in the non-relativistic calculation, are linked with the self-energy of the electron. If this energy is consistently subtracted these divergent terms are eliminated. G. J. K

530.145 : 537.581.5 177

On the production of mesons by nucleon-nucleon collisions. MORETTE, C., AND PENG, H. W. *Proc. R. Irish Acad.*, **51 A** (*No.* 17) 217–37 (*Feb.*, 1948).—The cross sections are found for $v/c \ll 1$ where v is the velocity of the incident nucleon, using radiation damping theory to calculate matrix elements. Small terms in the damping equation are neglected and the meson mass is assumed small in the calculations. Within these limitations the solution is exact. A charge-symmetric mixed meson theory is used. The cross-section increases fairly rapidly with the energy of the incident nucleon, while the distribution of mesons over their energy range is fairly uniform. G. J. K

530.145 : 539.153 *see Abstr.* 1890

530.145.6 177

Calculation of the potential from the asymptotic phase. FRÖBERG, C.-E. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 28, 16 *pp.* (1948).—The potential in Schrödinger's equation is determined in terms of the asymptotic solution as a function of the total energy, together with knowledge of the eigenfunctions. A systematic method is given for calculating successive approximations to the potential and wave functions alternately, together with explicit formulae. In the examples given only the first approximation is calculated. G. J. K

530.145.6 = 3 177

Two remarks on the theory of the scattering matrix. WENTZEL, G. *Helv. Phys. Acta*, **21** (*No.* 1) 49–58 (1948) *In German.*—1. The Heitler integral equation is not applicable to the problem of scattering by several centres simultaneously, as it incorrectly leads to transitions which are acausal in the sense used by Stueckelberg [*Helv. Phys. Acta*, **19**, 242 (1946)]. If the distance from the scatterer is large, an alternative form of integral equation can be given. 2. The method of analytical continuation in the complex-energy plane, using a scattering matrix related

the Kramers–Heisenberg dispersion formula, leads to escription of the spontaneous emission of light. G. J. K.

).162 = 4 1773

On Heisenberg's uncertainty relations. TORTRAT, A. *R. Acad. Sci., Paris*, **225**, 1280–2 (*Dec.* 22, 1947) *In ench.*—A discussion is given of the properties of the adratic form in variables u_i obtained from the expecta- n value of $(\Sigma u_i q^i)^2$ in wave mechanics, together with pressions for the uncertainties Δp, Δq for an expansion ψ in Hermite polynomials. G. J. K.

ENERAL MECHANICS . MECHANICS OF SOLIDS 531

1.18 : 530.12 : 535.1 *see Abstr.* 1794

1.19 : 541.183 *see Abstr.* 1934

1.252 : 620.179 : 535.55 *see Abstr.* 1827

1.252.2 1774

Relaxation methods applied to engineering problems. II. The flexure and extension of perforated elastic plates. UTHWELL, R. V. *Proc. Roy. Soc. A*, **193**, 147–71 *May* 27, 1948).

1.5 : 523.877 : 523.842 *see Abstr.* 1753

1.51 : 513.81 : 530.12 *see Abstr.* 1764

1.51 : 530.12 *see Abstr.* 1763

1.53 : 529.78 = 4 *see Abstr.* 1759

MECHANICAL MEASUREMENTS 531.7

1.752 1775

Photoelectric balance indicator. RULFS, C. L. *Analyt. em.*, **20**, 262–4 (*March*, 1948).

1.76 : 621.317.39 1776

Watch timer. MACKAY, R. S., JR., AND SOULE, R. R. *ectronics*, **21**, 160, 162, 164, 166, 168 (*Feb.*, 1948).— *bstr.* 1397 B (1948)].

MECHANICS OF LIQUIDS 532

2.13 1777

A method for the determination of viscosity at low rates shear. HOLLIDAY, A. K. *Trans. Faraday Soc.*, **43**,)–5 (*Oct.*, 1947).—A viscometer is described, in which velocity of travel of a microscopic iron sphere is easured, the sphere being moved in a horizontal plane rough the liquid by means of an electromagnet. An uation relating the velocity to the viscosity of the liquid d the distance d of the sphere from the magnet is rived and verified experimentally; by varying d, a wide nge of rates of shear can be obtained. The method is plied to the study of solutions of polymethyl metha- late, which exhibit non-Newtonian behaviour at dinary rates of shear. Provided that the mol. wt of polymethyl methacrylate $\geq$ 400 000, a range of rates shear can be obtained sufficiently low to make the shear e a linear function of the shearing stress, and the cosity values are then the rest viscosities of the utions. A.

2.13 1778

The theory of rate processes and the viscosity of long-ain compounds. WAKE, W. C. *Trans. Faraday Soc.*, 708–15 (*Nov.–Dec.*, 1947).—Eyring's theory of rate ocesses as applied to the viscosity of paraffin hydro- rbons is outlined, and the holes in a liquid are held to equivalent to a contribution to the flow process by ducing the energy required for it. An alternative method of estimating segmental size is described and the evaluation of the energetic equivalent of the holes, together with the cohesional forces of the paraffin chains, is shown to account reasonably well for the observed ΔH_{visc}. In this way a better picture of the process is obtained. A.

532.137 1779

Capillary-tube viscometer for routine measurements of dilute high-polymer solutions. WAGNER, R. H., AND RUSSELL, J. *Analyt. Chem.*, **20**, 151–5 (*Feb.*, 1948).

532.137 1780

Application of corrections in viscometry of high-polymer solutions. WAGNER, R. H. *Analyt. Chem.*, **20**, 155–7 (*Feb.*, 1948).

532.5 : 539.374 1781

The hydrodynamics of non-Newtonian fluids. I. RIVLIN, R. S. *Proc. Roy. Soc. A*, **193**, 260–81 (*May* 27, 1948).—The classical theory of the hydrodynamics of viscous fluids depends on the assumption of a particular law governing the relations between the components of stress in a fluid and those of the strain-velocity. This assumption limits its applicability to Newtonian fluids. Here, the most general possible relations between the stress and strain-velocity components, which can be obeyed by an incompressible, visco-inelastic fluid, are derived. These relations also apply to an incompressible, visco-elastic fluid in a steady state of laminar flow. It is shown how equations of motion and boundary conditions can be obtained if these relations are known. Two problems involving laminar flow are then discussed in some detail: (*a*) the torsional motion of a cylindrical mass of fluid, produced by means of forces applied to its plane ends, and (*b*) the laminar flow of a mass of fluid contained between two coaxial cylinders rotating with different angular velocities. It is found in (*a*) that, in general, normal tractions must be applied to the plane surfaces of the fluid, in addition to the azimuthal tractions expected from the classical theory, in order to produce the specified motion. Analogous results are obtained in (*b*). These results apply even when centrifugal forces are neglected and so imply a qualitative difference between the behaviour of fluids in general and those for which the special case of classical hydrodynamics is valid. A.

532.527 1782

On the total vorticity of motion of a continuous medium. TRUESDELL, C. *Phys. Rev.*, **73**, 510–12 (*March*, 1948).—A general kinematic formula for the rate of change of the total vorticity of a finite volume of a continuous medium is deduced. Two kinematic theorems follow: (*a*) in a motion filling all space the total vorticity is constant in time, provided that the motion vanishes at ∞ to a sufficiently high order; (*b*) the rate of change of total vorticity within an arbitrary volume is independent of the state of motion at all interior points of the volume. The mechanism of diffusion of total vorticity is then discussed in detail for the case of a viscous, compressible fluid. A.

532.527 1783

On the transfer of energy in continuous media. TRUESDELL, C. *Phys. Rev.*, **73**, 513–15 (*March*, 1948).—A formula for the rate of change of the kinetic energy of an arbitrary finite material volume of a Newtonian continuum is deduced. The general formula is then applied to the special case of a compressible viscous fluid, generalizing the theorem of Bobyleff and Forsyth. It is shown that the vorticity and the expansion play completely separate and exactly analogous parts in the dissipation of energy associated with viscosity. A.

CAPILLARITY 532.6

532.613 : 541.182 *see Abstr.* 1933

532.613.4 1784

Interfacial tension by the ring method: the benzene–water interface. CUPPLES, H. L. *J. Phys. Coll. Chem.*, **51**, 1341–5 (*Nov.*, 1947).—Measurements have been made of the interfacial tension at 25·0°C of the mutually saturated benzene–water system, using a du Nouy interfacial tensiometer and applying the appropriate Harkins *F*-factor. The average of 18 measurements, using three rings, is 32·67 dynes/cm, a value which is 2·01 dynes/cm < the generally accepted value. A.

KINETIC THEORY OF LIQUIDS 532.7

532.7 1785

Free-volume models for liquids. HILL, T. L. *J. Phys. Coll. Chem.*, **51**, 1219–32 (*Nov.*, 1947).—The fundamental functions of the van der Waals and Lennard-Jones and Devonshire models of classical liquids are compared with corresponding approximate functions obtained from experimental *PVT* data on N and A. Neither of these models is very satisfactory. The general form of the "experimental" functions should be useful as an approximate criterion of success of future free-volume models of liquids. Related calculations on H are discussed very briefly. It is possible to take into account the slight degeneracy near its critical point in only a very approximate manner. A new approximate model of a classical liquid is suggested which retains, on the one hand, the close connection between a crystal and the harmonic oscillator model of a liquid, and which, on the other hand, shows clearly the transition from liquid to gas. A.

532.72.096 + 533.15.096 = 3 *see Abstr.* 1786

MECHANICS OF GASES 533

533.15/.16 : 536.23 : 533.7 *see Abstr.* 1789

533.15.096 + 532.72.096 = 3 1786

The thermodiffusion effect. II. WALDMANN, L. *Z. Phys.*, **123** (*Nos* 1–2) 28–50 (1944) *In German.*—Extends the author's theory of thermodiffusion of binary gas mixtures [Abstr. 401 (1946)] to mixtures of any number of monatomic gases and to liquids. In all cases the energy of the diffusion particles = (thermodiffusion factor) × (Boltzmann constant × temperature). The thermodiffusion effect can be used to measure diffusion coefficients in gases. The temperature-time integral and variation curve in cylindrical diffusion vessels is calculated and the results are discussed. V. W. R.

533.15.096 : 539.155.2 *see Abstr.* 1894

533.275 : 545.7 : 621.317.39 1787

Measurement of water in gases by electrical conduction in a film of hygroscopic material. Use of pressure changes in calibration. WEAVER, E. R., AND RILEY, R. *Analyt. Chem.*, **20**, 216–29 (*March*, 1948).—The electrical conductivity of a thin film of such a material as phosphoric acid changes over a wide range with changes in the concentration of water in the atmosphere with which it is in contact. By adjusting the pressures of a sample of gas of known and one of unknown composition, they can be made to have the same concentration of water, shown by equal resistances of the detecting film. Apparatus and procedures for determining water vapour under a variety of circumstances are described, and characteristics of the method and sources of error are discussed. The method has the general merits of simplicity of operation, speed, great sensitivity and wide range. Only small samples are needed, and few substances interfere. Several applications are described.

533.5 : 621.314.65.032.46 = 3 1

Gas clean-up by iron walls in vacuum discharge appara and its bearing on the life of pumpless rectifiers. DECK, *Brown Boveri Co. Nachr.*, **30**, 46–8 (*April–Sept.*, 19 *In German.*—[Abstr. 1349 B (1948)].

KINETIC THEORY OF GASES 533.7

533.7 : 533.15/.16 : 536.23 1

Low temperature transport properties of gases. II. Ne argon, krypton, and xenon. AMDUR, I. *J. Chem. Ph* **16**, 190–4 (*March*, 1948).—Values are computed for t viscosity, thermal conductivity and coefficient of s diffusion, as functions of temperature. The method calculation is the same as that previously developed f gaseous He [Abstr. 2796 (1947)] to obtain appropri classical transport cross-sections. The average absol deviations between calculated and experimental valu are 5·5% for viscosity and 5·9% for thermal conductivi In the case of self-diffusion, only two experimental valu are available for comparison with calculated values, o each for Kr and Xe. The absolute deviations are 9 and 10·3% respectively. A procedure is suggested f obtaining approximate values of the mutual diffusi coefficient of a binary gas mixture from the self-diffusi coefficients of the constituents.

533.7 : 536.633 *see Abstr.* 1838

VIBRATIONS . ACOUSTICS 534

534.01 1

Daniel Bernoulli's mechanical problem. SNEDDON, I. *Phil. Mag.*, **39**, 229–35 (*March*, 1948).—The method the finite Hankel transform [Abstr. 4 (1947)] is used solve the problem of the free and forced vibrations of heavy chain of finite or infinite length, suspended ve tically from one end. Expressions for the transver displacement are obtained. The method is an improv ment on that of the Laplace transform. L. S.

534.21 : 550.341 *see Abstr.* 1946

534.23 : 534.24 : 536.48 1

Wave transmission and reflection phenomena in liqu helium II. PELLAM, J. R. *Phys. Rev.*, **73**, 608– (*March* 15, 1948).—A method is formulated for treati acoustical transmission and boundary value proble in liquid He II. A reformulation of the intrinsic characteristic) acoustical impedance concept is requir for which a matrix representation is applicable. similarly associating a matrix form of impedance wi plane-reflecting surfaces, boundary conditions may imposed. The classical requirements (continuity pressure and particle velocity at the boundary) a generalized to apply individually to each fluid co ponent in He II. Expressions are obtained for t reflective properties of various types of surfaces. particular, materials which present unlike boundary co ditions to the two fluid components are shown capab of partially converting one mode of sound to the oth upon reflection. These properties of reflectors a expressed in terms of *reflectivity arrays*. The array giv direct reflective factors for both types of sound, pl coupling factors between types. Examples are given f several special cases, and a form of reciprocity is show to exist for the coupling process. The boundary conditio is derived for still another type of coupling, due to he transfer, which occurs at a liquid-vapour interface;

lified form is applicable to the resonance type eriment. A.

24 : 536.48 : 534.23 *see Abstr.* 1791

321.9 : 534.614 1792

Ultrasonic velocity in a series of 1-olefins. LAGEMANN, T., MCMILLAN, D. R., JR., AND WOOLSEY, M. *Chem. Phys.*, **16**, 247–9 (*March*, 1948).—The velocity 500 kc/s has been measured from 10–30°C for seven mbers of a 1-olefine series. Densities and refractive ices were also measured. From the measurements, ues of the molecular sound velocity, adiabatic com- ssibility, and molecular refractivity were computed. e ultrasonic velocity is ∝ temperature, while the mole- ar constant, $MV^{\frac{1}{3}}/d$, remains substantially constant. e constant is found to be strictly additive for the series mbers studied. A.

.6 : 621.317.37 1793

Standard lag line for phase measurement. SCHUCK, H. *J. Acoust. Soc. Amer.*, **20**, 26–39 (*Jan.*, 1948).— bstr. 1394 B (1948)].

.614 : 534.321.9 *see Abstr.* 1792

OPTICS . RADIATION . SPECTRA 535

5.1 : 530.12 : 531.18 1794

Phase velocity and group velocity in relativistic optics. TCHBURN, R. W. *Rev. Opt.* (*Théor. Instrum.*) **27**, 4–14 *an.*, 1948).—Discusses the equality of the phase and oup velocities of light *in vacuo*. R. A. N.

5.12 = 4 1795

Huygens' principle in the optics of bodies in motion. sco, M. *J. Phys. Radium* (*Sér.* 8) **8**, 282–8 (*Sept.*, 47) *In French.*—In the relativistic formulation, the herical secondary waves of the classical form of uygens' principle are replaced by surfaces having the rm of Pascal's limaçon. This form of surface repre- nts a variation of wavelength with direction in the case f a wave emitted by a moving point source. Reflection om a moving mirror, aberration and the Döppler effect e studied using the method. The spectra of moving ratings (both transmitting and reflecting) are studied in eat detail. H. H. HOP.

35.13 : 535.39 = 3 *see Abstr.* 1822

35.234 1796

A table of Planckian radiation. MOON, P. *J. Opt. pc. Amer.*, **38**, 291–4 (*March*, 1948).—A table is presented or the radiation from a Planckian radiator operating etween 2 000 and 3 500°K (100° intervals). Values of $\Psi(\lambda)$ are given for a wavelength range of 0·38 to 0·76μ t 0·01μ intervals. This is part of a more extensive table 10° intervals) that has been published. A.

35.237 : 535.642 1797

Analytic representation of experimental spectroradio- metric curves. MOON, P., AND SPENCER, D. E. *J. Franklin Inst.*, **244**, 441–64 (*Dec.*, 1947).—Gives polynomial analytic expressions which represent closely the spectral distribution curves found experimentally for a number of light sources, including different phases of daylight and various types of fluorescent lamps. The use of these expressions for finding the colorimetric coefficients is explained. J. W. T. W.

535.247.4 : 621.383 : 621.317.794 1798

A new radiation meter. KALMUS, H. P., AND STRIKER, G. O. *Rev. Sci. Instrum.*, **19**, 79–82 (*Feb.*, 1948).—[Abstr. 1421 B (1948)].

535.313 1799

On the interpretation of the Foucault test. LINFOOT, E. H. *Proc. Roy. Soc. A*, **193**, 248–59 (*May* 27, 1948).—The diffraction theory of the Foucault test is applied to discuss the intrinsic errors of the test when the Foucault shadows are interpreted by means of the "grazing light" fiction in the usual manner. Formulae are obtained for the effects on the Foucault shadows of an arbitrary small change in the figure of the mirror under test. The case of a weak, narrow local zone on an otherwise nearly true mirror is discussed, and expressions are obtained in terms of the zone-profile for the changes in the Foucault shadows caused by the presence of the zone. The relationship between the zone-profile inferred by means of the "grazing light" interpretation of the shadows and that actually present on the mirror is analysed, suggesting some modifications in the practical technique of figuring mirrors under the Foucault test. The general formulae established for weak, narrow zonal errors are compared with the results of computation in four selected special cases. The formulae may provide useful approximations for the mirror-maker. A.

535.317 : 526.918.5 : 535.8 *see Abstr.* 1832

535.317.25 : 535.317.4 : 535.833 *see Abstr.* 1835

535.317.4 : 535.317.25 : 535.833 *see Abstr.* 1835

535.32 : 535.34 : 537.226.029.6 *see Abstr.* 1843–5

535.32.096 : 539.11 : 549.514.51 1800

Temperature variation of the refractive index of quartz. RADHAKRISHNAN, T. *Proc. Indian Acad. Sci., A*, **27**, 44–51 (*Jan.*, 1948).—The temp. coefficient of n_{5461}, measured interferometrically between −190° and 400°, has been used to calculate the temp. shift of the electronic frequency in quartz at 1 100 Å. As with diamond, zinc blende and vitreous silica, the temp. coefficient of the electronic frequencies ≃ those of the lattice frequencies. In each substance the electronic frequencies tend to stationary values at low temp., suggesting that this result is a general property of solids. W. R. A.

535.33 : 551.593.9 : 551.594.5 = 4 1801

Emission spectra of the night sky and Aurora Borealis. KASTLER, A. *Rev. Sci., Paris*, **85**, 917–20 (*Sept.* 1 *and* 15, 1947) *In French.*—A useful summary of papers read at the Gassiot Committee Symposium (London, July, 1947). Recent work is reviewed, and new instrumental techniques are described. D. R. B.

535.33–1 1802

Infra-red instrumentation and techniques. WILLIAMS, VAN Z. *Rev. Sci. Instrum.*, **19**, 135–78 (*March*, 1948).—A comprehensive review, with 210 references. Most attention is paid to the range 2·5–25 μ, but sections are included on the very near infra-red (0·75–2·5 μ), the far infra-red (25–300 μ) and the microwave region (∼1 cm). Theoretical and empirical applications are discussed, and sources, dispersive media, detectors, recorders and complete instruments reviewed (19 figures).

535.33.03 : 535.375.5 1803

Some spectral characteristics of mercury arcs for use in study of the Raman effect. RANK, D. H., AND MCCARTNEY, J. S. *J. Opt. Soc. Amer.*, **38**, 279–81 (*March*, 1948).—Several types of commercial Hg arcs and low pressure arcs were investigated with regard to the continuous background in the λ4358 region. The background intensity measurements were made relative to the λ4358 line making use of the Rowland grating ghosts, using a photoelectric spectrograph. It was found that the relative intensity of the λ4358 group of lines in the Hg spectrum varies almost an order of magnitude with the different vapour pressures used in the various sources. An intense photograph of the Raman spectrum of CS_2 has been obtained in which ν_3, $\Delta\nu \sim 1\,520\ cm^{-1}$, appears. This line is forbidden for a linear molecule and

is only about $\frac{1}{1000}$ the intensity of the strongest line in the spectrum. A.

535.33.072 : 778.53 : 536.46 1804

A cinema-spectrograph for photographing rapid spectral sequences. HERMAN, R. C., AND SILVERMAN, S. *J. Opt. Soc. Amer.*, **38**, 209–11 (*Feb.*, 1948).—A simple spectrograph designed around a 16-mm movie camera is described. It was built for obtaining spectrograms from light sources showing transient phenomena, in particular the new types of rocket and jet combustion engines. The study of the light emitted from an acetylene-oxygen flame as a function of time illustrates its usefulness. A.

535.33.072–15 1805

A calibration method for infra-red prism spectrometers. MCKINNEY, D. S., AND FRIEDEL, R. A. *J. Opt. Soc. Amer.*, **38**, 222–5 (*March*, 1948).—A method of high accuracy applicable to various prisms in infra-red spectrometry has been used to calibrate NaCl and KBr prisms. The method requires only a small number of experimental bands, is practically independent of resolving power, provides an extensive wavelength range, and permits a tabulated calibration without the necessity of drawing calibration curves. The procedure is described in detail with an example. A.

535.332 1806

Wavelength measurements and new energy levels in the arc spectrum of fluorine, F I. LIDÉN, K. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 24) 13 *pp.* (1948).—New measurements of F I lines excited in a hollow cathode tube, combined with Stark effect observations [Abstr. 1807 (1948)] have led to the assignment of 60 new lines between 5 538 and 7 110 Å as transitions $3p$–$5s$ and $3p$–$4d$. The results are discussed and the $(^3p)5s$ terms compared with theoretical values for intermediate coupling. R. F. B.

535.332 : 537.228.5 1807

Stark effect in the spectrum of neutral fluorine, F I. LIDÉN, K. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 23) 20 *pp.* (1948).—The shifts of 44 lines of F I arising from transitions $(^3P)3p$–$4d$, $(^3P)3p$–$5s$ and $(^1D)3s$–$3p$ excited in a cathode layer tube running in SF_6 were measured for field strengths of 35 to 180 kV/cm. Lines $(^3P)3s$–$3p$ show no observable effect. Experimental details are described and the results discussed. R. F. B.

535.338 : 542.9 = 4 *see Abstr.* 1937

535.338.334–15 1808

Indirect measurement of spectral line breadth in the infra-red. THORNDIKE, A. M. *J. Chem. Phys.*, **16**, 211–13 (*March*, 1948).—If infra-red absorption by a sample gas is measured at low resolution in the presence and absence of pressure broadening by a non-absorbing gas, information may be obtained concerning breadth and fine structure of individual rotational lines. Data on 590-cm^{-1} and 1 285-cm^{-1} bands of N_2O indicate self-broadening coefficients of about 0·21 and 0·13 cm^{-1} per atmosphere, respectively. These values may be compared with 0·20 cm^{-1} per atmosphere obtained by Adel and Barker by direct measurement on the 590-cm^{-1} band. A.

535.34 : 535.32 : 537.226.029.6 *see Abstr.* 1843–5

535.341 : 551.593.5 : 535.88 = 4 1809

Method of measuring atmospheric transmission and its use in the photometry of large projectors. REY, A., AND FÉVROT, C. *Rev. Opt. (Théor. Instrum.)* **27**, 35–56 (*Jan.*, 1948) *In French.*—Atmospheric transmission may be measured by means of a beam of the smallest possible divergence traversing the range to be used. This beam is formed by a source of very small dimensions placed at the focus of a lens of long focal length. After traversing between 0·5 and 1 km of the atmosphere the beam falls on a large concave mirror which concentrates it on t photometer box and here the total flux transmitted be measured. The ratio of this to the total flux in beam as it leaves the lens gives the atmospheric tra mission. J. W. T.

535.343–14 : 539.152.1 : 538.222 *see Abstr.* 1875

535.343.4 : 537.568 18

An approximate formula for the continuous radiat absorption cross-section of the lighter neutral atoms a positive and negative ions. BATES, D. R. *Mon. Not. Astr. Soc.*, **106** (*No.* 5) 423–31 (1946).—The form derived is applied to Be, C^+, N^+, O^+, F^+, Ne^+ a Na^+. A. E

535.343.4 : 537.568 18

Calculation of the cross-section of neutral atoms a positive and negative ions towards the absorption radiation in the continuum. BATES, D. R. *Mon. Not. Astr. Soc.*, **106** (*No.* 5) 432–45 (1946).—The use quantum mechanics in this problem is reviewed, w particular reference to the practical difficulties a limitations of accuracy. The general results to expected for various groups in the periodic table a discussed. The detailed work already done is summariz and future prospects indicated. A. H

535.343.4–31 18

Ultraviolet absorption spectrum of hydrogen peroxi HOLT, R. B., MCLANE, C. K., AND OLDENBERG, *J. Chem. Phys.*, **16**, 225–9 (*March*, 1948).—The absorpti coefficient for vapour in the wavelength range 185 2 200 Å was determined. A careful redetermination the absorption coefficients for the vapour and f aqueous solutions at 2 537 Å was also made.

535.345.6 = 4 18

Accuracy and method of use of coloured filters, pa ticularly gelatine filters. BIOT, A. *Ann. Soc. Sc Bruxelles*, **61** (*Sér. I*) 242–9 (*Dec.* 12, 1947) *In French.* After a mathematical treatment of the theory of tran mission through a transparent medium, particularly solution which obeys Beer's law, the author describes th preparation of a gelatine filter and mentions some of th possible defects. For a liquid filter, the thickness and th concentration must be accurate to 1% in order to give precision of 0·0025 in the value of the transmissio factor. J. W. T. W

535.35 : 551.594.5 : 539.13 *see Abstr.* 1885

535.371 181

Influence of Mn concentration and temperature on th radiation of Zn and Mn in ZnS.Mn-phosphors. LEWSCHI W. L. *C.R. Acad. Sci. URSS.*, **54** (*No.* 3) 215–18 (1946).— A continuation of previous work [Abstr. 1509 (1948)] Curves obtained from experimental data show th increase in the luminescence of the blue Zn band an yellow Mn band with growth in the intensity of th exciting light for various Mn concentrations. It i concluded that direct excitation of Mn is unimportant The effect of heating on the interaction of the bands wa investigated. Heating speeds up the decay of the M centres, destroys saturation, and increases the brightnes of the yellow luminescence and decreases the blue Further heating leads to quenching. L. S. G

535.371 181

Fluorescence efficiency and hole migration in zin sulphides. WISE, M. E., AND KLASENS, H. A. *J. Opt Soc. Amer.*, **38**, 226–31 (*March*, 1948).—General equa tions are derived for predicting the change in fluorescen intensity of ZnS phosphors containing more than one kin of impurity activating centre, according to the theory o hole migration. The effect on the blue fluorescence

ency of exciting intensity, temperature, and one r kind of centre is discussed. If this other centre is ler which produces no visible radiation, it is shown the observed fluorescence of ZnS–Ag–Co quantita- y agrees with the theory if the probability that a lecular excited Co centre will recombine with an ron in the conduction band in unit time ≫ corre- ıding probability for a Ag centre. The influence of pendent electron traps on the hole migration is also ıssed. A.

371 1816

new method of preparing strongly luminescent ium activated alkali halides and some properties of e phosphors. HUTTEN, E. H., AND PRINGSHEIM, P. *hem. Phys.*, **16**, 241–6 (*March*, 1948).—Phosphors a bright visible fluorescence and a long-lasting after- can be prepared by grinding KCl with small ıunts of a thallous salt in a mortar. The character of luminescence spectra and the phosphorescence decay ends on the Tl concentration. The behaviour of other li halides under the same treatment and some con- ions concerning the probable carriers of the lumi- cence are discussed. A.

.371 = 3 1817

On the extinction of the afterglow of ZnS–Cu and –Bi phosphors. BANDOW, F. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 399–404 (1947) *In German.*—The ay of the luminescence of ZnS–Cu and CaS–Bi sphors was measured by photographic means. The ay characteristics of the reduced phosphorescence r (*a*) pressure treatment, and (*b*) α-ray irradiation, are npared with those of the normal phosphors. Pressure uced the initial brightness to $\frac{1}{3}$th, and influenced the pe of the decay very little. The α-ray intensity lized halved the intensity during excitation and uced the afterglow after 2 min to $\frac{1}{25}$th, and the total ay to $\frac{1}{40}$th. C. C.

5.371 = 82 1818

Zinc-sulphide luminophors, containing lead. CHEREP- , A. A. *C.R. Acad. Sci. URSS*, **56** (*No.* 8) 807–10 47) *In Russian.*—The use of Pb as an activator for S luminophors is investigated, and their flash and sistence properties under exposure to red and infra- l radiation described. A. L.

5.371 : 537.312.5 *see Abstr.* 1854

5.375.5 1819

On the Raman spectra of solutions of ethylene di- mide in different solvents. BISHUI, B. M., AND NYAL, S. B. *Indian J. Phys.*, **30**, 233–8 (*Oct.*, 1947).

5.375.5 : 535.33.03 *see Abstr.* 1803

5.375.5 : 535.51 1820

Determination of the depolarization factors of highly larized Raman lines. DOUGLAS, A. E., AND RANK, . H. *J. Opt. Soc. Amer.*, **38**, 281–8 (*March*, 1948).— e errors arising in the measurement of the depolariza- n factor of highly polarized Raman lines are discussed. rticular attention is given to the error introduced by e convergence of the incident light. It is shown that e ratio of the intensity of the parallel component of the attered light when incident light is polarized along the rection of observation of the sample, to the intensity of e parallel component when the incident light is polarized rpendicular to this, gives a value of the depolarization ctor ρ_s that is very nearly free from convergence errors. ρ_n = the depolarization factor in unpolarized light, $= 2\rho_s/(1 + \rho_s)$. Using this method, the depolariza- n factors of some highly polarized lines were measured th a photo-electric spectrograph. They were found to be considerably below previously accepted values. The depolarization factors ρ_n for the most highly polarized lines of CCl_4 and C_6H_6 were found to be 0·013 and 0·038, respectively. It is shown that the ρ_n is not constant across the width of the line for many Raman lines. A.

535.39 = 4 1821

Reflection by several parallel layers. BRINKMAN, H. *Rev. Opt.* (*Théor. Instrum.*) **27**, 31–3 (*Jan.*, 1948) *In French.*—A simple derivation of an earlier formula due to Smith [Abstr. 660 (1927)] expressing the reflection/ transmission ratio of a pile of plates. H. H. HOP.

535.39 : 535.13 = 3 1822

A new and fundamental experiment on total reflection. GOOS, F., AND HÄNCHEN, H. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 333–46 (1947) *In German.*—In the case of total reflection the reflection does not take place sharply at the interface of the two media, but there is a penetration of the wave into the rarer medium, which should result in a lateral displacement of the reflected beam. In the experiment described, multiple reflections of a beam of light occur, part of the beam falling on a silvered glass surface and part on a glass-air interface. As many as 74 such reflections take place, rendering the relative lateral displacement of the two parts of the beam subject to accurate measurement. The measurements lead to an empirical value of a constant in the theoretical expression for the displacement of the reflected beam. H. H. HOP.

535.39 : 535.51 : 539.2 1823

Studies of surface films by reflection of polarized light. I. A more rigorous algebraic method for computing results. LUCY, F. A. *J. Chem. Phys.*, **16**, 167–74 (*March*, 1948).

535.417 : 621.317.763.029.64 = 4 1824

A microwave interferometer. KAHAN, T. *J. Phys. Radium* (*Sér.* 8) **8**, 192 (*June*, 1947) *In French.*—[Abstr. 1420 B (1948)].

535.43 : 535.51 1825

Intensity and polarization of Brillouin spectra. RANK, D. H., MCCARTNEY, J. S., AND SZASZ, G. J. *J. Opt. Soc. Amer.*, **38**, 287–90 (*March*, 1948).—Apparatus is described for the production of intense Brillouin spectra. The fine structure of the transverse scattered light (Rayleigh scattering) was analysed by means of a large Fabry and Perot étalon placed in the parallel beam of a high aperture glass spectrograph, and interferograms obtained of the Brillouin spectrum of acetone, ethyl alcohol, and water using λ4078 of Hg as the exciting line. Intensity measurements of these interference patterns show that the theory of Landau and Placzek is a very close approximation to the truth in the spectra investigated. Polarization measurements were made on these spectra excited by λ4358 Hg by the method of Douglas and Rank [Abstr. 1820 (1948)]. These polarization measurements show that ρ_s is small but not zero for the modified Brillouin components. The polarization of the unmodified Brillouin components seems to be somewhat less complete than that of the modified components, but the measurements on these lines are vitiated by parasitic light. A.

535.43 : 551.593.5 *see Abstr.* 1957

535.43 : 551.594.6 : 621.396.9 : 538.56 *see Abstr.* 1880

535.43 : 621.392.26 : 538.56 *see Abstr.* 1881

535.5 : 539.166 *see Abstr.* 1907

535.5–15 1826

The polarization of infra-red radiation. ELLIOTT, A., AMBROSE, E. J., AND TEMPLE, R. *J. Opt. Soc. Amer.*, **38**, 212–16 (*Feb.*, 1948).—A transmission polarizer for the

near infra-red is described, which is small and compact and can be mounted on a spectrometer without alteration of the existing optical system. It employs a pile of self-supporting Se films, each $\sim 4\,\mu$ thick. The advantages which such a polarizer possesses over other forms are pointed out, and the factors affecting the design of the pile are briefly discussed. The method of preparing the Se films is described in detail. The percentage polarization, measured by crossing two similar piles, is $> 94\%$ with 5 films, and $> 98\%$ with 6 films in each pile, over the spectral region 2–14 μ; the maximum transmission is 47% of the incident radiation. No absorption bands of Se could be detected between 1 and 14 μ using a much thicker layer (52 μ). A.

535.51 : 535.375.5 *see Abstr.* 1820

535.51 : 535.43 *see Abstr.* 1825

535.51 : 539.2 : 535.39 *see Abstr.* 1823

535.55 : 531.252 : 620.179 1827

Recent developments in photo-elasticity. WARD, J. *Trans. Inst. Mar. Engrs*, **59**, 223–38 (*Dec.*, 1947).—In an historical introduction, the methods of obtaining stresses by (*a*) colour matching, (*b*) compensation are considered, and the problem of separating the principal stresses P and Q is examined. Details of construction of polariscopes and some of the elasticity and optical theory necessary for the study of photo-elasticity, especially with reference to the technique of using monochromatic circularly-polarized light and counting interference fringes, are given; the latter is fully explained. Suitability of materials (e.g. B.T.-61-893, Catalin 800 and C.R. 39) is discussed with special regard to creep and edge stresses. Examples, with photographs, of stress analysis are given for discs and rollers, gear teeth, lathe turning stresses, forced fits, eccentric loading and for a boiler tube plate. For 3-dimensional work, the scattered light method and the frozen stress technique with application to dynamic loading is mentioned. A discussion by others includes the determination of $(P + Q)$ by solving Laplace's equation by successive approximations, reference to dynamic loading arising from centrifugal forces and the problem of plane strain investigated by plane stress models. H. G. J.

535.642 : 535.237 *see Abstr.* 1797

535.66 : 628.97 1828

Colour characteristics of human complexions. BUCK, G. B., II, AND FROELICH, H. C. *Illum. Engng, N.Y.*, **43**, 27–49 (*Jan.*, 1948).—[Abstr. 1617 B (1948)].

535.7 : 551.593.9 1829

The visibility of distant objects. DUNTLEY, S. Q. *J. Opt. Soc. Amer.*, **38**, 237–49 (*March*, 1948).—The purpose of this paper is to identify the principal factors involved in the visibility of an object, to indicate how each factor affects the range of visibility, and to supply charts which, by combining these factors, enable the limiting range to be found under any set of prevailing conditions. A.

535.7 1830

A comparison of computed and experimental detection ranges of objects viewed with telescopic systems from aboard ship. COLEMAN, H. S., AND VERPLANCK, W. S. *J. Opt. Soc. Amer.*, **38**, 250–4 (*March*, 1948).—The relative range performance of ~ 80 telescopic systems of 18 different designs has been determined by statistical methods based on the results of a field test conducted from shipboard. The range at which objects are detectable from aboard ship is compared with the range computed from laboratory measurements of light transmission, magnification, exit pupil, and contrast rendition. The agreement between the results of the field tests a the computations is extraordinarily good.

535.8 : 525.73 1

The reduction of apparent contrast by the atmosphe DUNTLEY, S. Q. *J. Opt. Soc. Amer.*, **38**, 179–90 (*Fe* 1948).—A veil of atmospheric haze reduces the visibil of all distant objects by decreasing their appar contrast. In this paper equations are derived wh describe the manner in which the apparent contrast any object depends upon the distance of the observer. T treatment is not limited to horizontal paths of sight, to the case of a homogeneous standard atmosphere; th may be applied to many kinds of non-standard atn spheric conditions. For every path of sight there exist luminance level which will be transmitted unchang The apparent luminance of any receding obj approaches this equilibrium level. For many paths sight the equilibrium luminance is matched by luminance of some portion of the horizon sky.

535.8 : 535.317 : 526.918.5 1

Lenses of extremely wide angle for airplane mappi GARDNER, I. C., AND WASHER, F. E. *J. Res. Nat. B Stand., Wash.*, **40**, 93–103 (*Feb.*, 1948).—If the illumin tion of the image produced by a wide angle lens cover a field of 120 degrees follows the $\cos^4$ law, the illuminati at the edge of the field will be $\frac{1}{16}$th that at the centre the absence of vignetting. By introducing negat distortion, the illumination may be expected to be m uniform from the centre to the edge of the field. particular, if there is no vignetting, and if the diaphra precedes the lens, there will be uniform illumination, ev for a field as great as 180°, if the distortion is such th $r' = f \sin \beta_1$ where r' is the distance from centre of field to a given image point, β is the correspondi angular distance from the axis in the object space, an is the focal length corresponding to the part of the ima in the neighbourhood of the axis. Detailed results tests on a German Pleon mapping lens and a rectify unit are given. The lens covers a field of 130°, and distortion closely follows the law $r' = f\beta$ (somewhat l than that of the preceding formula). Measurements the resolving power, of the effective size of the entra pupil for different angular distances from the axis, a of the net distortion of the two systems are reported. a final print there is significant residual distortion result from the failure of the distortions of the two systems annul each other exactly.

535.8 : 621.391.63 1

Survey of near infra-red communication syste HUXFORD, W. S., AND PLATT, J. R. *J. Opt. Soc. Am* **38**, 253–68 (*March*, 1948).—The development of meth of communication by means of light beams is revie from 1880 to 1945. The review is limited to voice a code systems, and includes a discussion of methods producing modulated beams of radiation, use of filters provide security in military applications, and a summ of the various types of photo-sensitive receiving eleme used. Descriptions of several types of foreign light-be communication equipments are included. (Bibliograp of 61 refs.)

535.8 : 621.391.63 1

Principles of optical communication systems. Gene properties of non-image forming projectors and receiv SNYDER, H. S., AND PLATT, J. R. *J. Opt. Soc. Amer.*, 269–78 (*March*, 1948).—The factors are discussed wh determine the range of an optical communication syste such as: atmospheric transmission; source area, fi brightness, modulation, and audio pass-band; tra mitter and receiver focal lengths, areas, and be

ths; and detector cell noise and area. Detector cell al/noise ratio ∝ (cell area)$^{-\frac{1}{2}}$ in the ideal case. For n-image-forming systems, the Abbé sine condition is laced by a useful rule of constancy of area × solid le. A wide-angle system is a short-range system. A eral equation is given relating the range to these tors; it leads to a simple nomograph for estimating formance of a system. From laboratory measure- nts on components, the field range of a system may predicted to an accuracy of ± ¼ mile if the atmospheric nsmission is known. A.

.833 : 535.317.4 : 535.317.25 1835

The loss in resolving power caused by primary astig- tism, coma, and spherical aberration in telescopic tems. COLEMAN, H. S., AND HARDING, S. W. *J. Opt. c. Amer.*, **38**, 217–21 (*March*, 1948).—Resolution asurements were made using Foucault test objects various inherent brightness contracts. Results of these asurements were analysed in terms of the magnitude the aberrations expressed in terms of the Rayleigh it appropriate to the best visual focus for the telescopic stems under consideration. For high contrast test jects, the loss in resolution ≃ 5% per Rayleigh limit d different for each aberration. The loss per Rayleigh it was found to be greatest for astigmatism and least r coma. On a percentage basis, the loss in resolution used by a given aberration was found to be greater for st objects of low contrast than for those of high ntrast. A.

5.88 : 551.593.5 : 535.341 = 4 *see Abstr.* 1809

HEAT 536

6.2 1836

Temperature distribution in some simple bodies develop- g or absorbing heat at a linear function of temperature. KOB, M. *Trans. Amer. Soc. Mech. Engrs*, **70**, 25–30 *an.*, 1948).—An investigation on bodies of the same rm as those of Abstr. 543 (1944), but producing oulean heat or heat of reaction at a rate decreasing nearly with rising temp., or absorbing heat by endo- hermic reaction with a constant pos. or neg. temp. efficient. The equations of temp. distribution derived re closely related to the previous ones in their form as ell as in the occurring functions. A.

36.23 : 533.15/.16 : 533.7 *see Abstr.* 1789

36.421.1 : 539.264 *see Abstr.* 1921

36.46 : 541.126 *see Abstr.* 1928–9

36.46 : 778.53 : 535.33.072 *see Abstr.* 1804

36.48 : 534.24 : 534.23 *see Abstr.* 1791

36.62 1837

Adiabatic calorimeter. For specific heat determinations ver the temperature range 25° to 300°C. STOW, F. S., JR., ND ELLIOTT, J. H. *Analyt. Chem.*, **20**, 250–3 (*March*, 948).

36.633 : 533.7 1838

Simple expressions for the heat capacities of gases. RAWFORD, B. L., JR., AND PARR, R. G. *J. Chem. Phys.*, 6, 233–6 (*March*, 1948).—A table of constants is given whereby one may at once write down, knowing the ibrational frequencies, the best approximation of the orm $C_p^\circ = A_0 + A_1T + A_2T^2$ to the heat capacity of a as with translational, rotational, and vibrational harmonic) degrees of freedom. A.

THERMODYNAMICS 536.7/.8

536.7 1839

Thermodynamic functions for molecular oxygen in the ideal gas state. WOOLLEY, H. W. *J. Res. Nat. Bur. Stand., Wash.*, **40**, 163–8 (*Feb.*, 1948).—The functions have been calculated using recent values of physical and spectroscopic constants. Values of C_p°, $H^\circ - E_0^\circ$, $-(F^\circ - E_0^\circ)/T$, and S° are given, directly calculated or interpolated, for every twenty degrees up to 700°K and for every hundred degrees up to 5 000°K. A.

536.71 : 541.126 *see Abstr.* 1930

ELECTRICITY 537

537.123 : 537.591 : 530.12 *see Abstr.* 1765

537.133 = 4 1840

On the field of an electron. PETIAU, G. *Rev. Sci., Paris*, **85**, 916 (*Sept.* 1 *and* 15, 1947) *In French.*—A radius of $\sim 12e^2/mc^2$ can be defined for an electron by equating its mass with the energy of its magnetic field instead of the usual electric field. Similar radii can be defined for neutron and proton. G. J. K.

537.133 : 530.145 *see Abstr.* 1769

537.226 1841

Electric polarisation in keratin–water and keratin–methyl alcohol systems. KING, G. *Trans. Faraday Soc.*, **43**, 601–11 (*Aug.–Sept.*, 1947).—The permittivity of water–keratin and methyl alcohol–keratin systems has been investigated for increasing concentrations of the absorbate. The results are examined in the light of the multimolecular theory of sorption and it is concluded that the increase in permittivity is unlikely to be a function of the absorbate alone. A comparison is drawn between the dielectric dispersion and the elastic properties of keratin–water systems. It is suggested that in both cases the "bound" water fraction breaks H bonds between the polypeptide chains, allowing increased freedom of rotation of polar groups in these chains. A.

537.226 : 537.529 *see Abstr.* 1866

537.226 : 621.315.61.011.5 = 3 1842

Dielectric behaviour of ice. EDER, F. X. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 381–98 (1947) *In German.*—[Abstr. 1361 B (1948)].

537.226.029.6 : 535.32 : 535.34 1843

The anomalous dispersion of water at very high radio frequencies. I. Experimental determination of the dielectric properties of water in the temperature range 0°C to 40°C for wave-lengths of 1·24 cm and 1·58 cm. SAXTON, J. A., AND LANE, J. A. *Rep. Phys. Soc., Lond. and R. Met. Soc.* "*Meteorological factors in radio-wave propagation*," 278–92 (1947).—Measurements of the refractive index and absorption coefficient were made by a free-wave method. Experimental results are in general qualitative agreement with the Debye theory. Sea water has similar properties in the same wave-band. The absorption coefficients are considered accurate to ∼1% and the refractive index values to within 2%. W. J. G. B.

537.226.029.6 : 535.32 : 535.34 1844

The anomalous dispersion of water at very high radio frequencies. II. Relation of experimental observations to theory. SAXTON, J. A. *Rep. Phys. Soc., Lond. and R. Met. Soc.* "*Meteorological factors in radio-wave propagation*," 292–306 (1947).—Discussion of recent theories on permittivity of a pure polar liquid. Good agreement is noted between theory and experimental results given in I, and also with other experimental data on wavelengths up to 10 cm, provided a higher value for the atomic polarization is assumed than has been used hitherto. W. J. G. B.

537.226.029.6 : 535.32 : 535.34 1845

The anomalous dispersion of water at very high radio frequencies. III. The dipole relaxation time and its relation to the viscosity. SAXTON, J. A. *Rep. Phys. Soc.*,

Lond. and R. Met. Soc. "*Meteorological factors in radio-wave propagation*," 306–16 (1947).—Recent experimental determinations of the dielectric properties of water at wavelengths of the order of 1 cm, and in the temperature range 0°–40°c, are examined on the basis of Eyring's theory of absolute reaction rates. It is confirmed that a fundamental similarity exists between the ultimate mechanisms of a dipole rotation and viscous flow. The assumption of a simple constant of proportionality (the same for all temperatures) between the free energies of activation to be associated with viscous flow and dipole rotation, regarding these two phenomena as rate processes, is sufficient for the determination of the dielectric properties from a knowledge of the viscosity, the atomic polarization and static permittivity also being known. A single relaxation time, as a function of temperature, seems adequate to account for dipolar dispersion in water. W. J. G. B.

537.226.029.6 : 538.569.3 : 621.396.11 1846

The dielectric properties of water vapour at very high radio frequencies. SAXTON, J. A. *Rep. Phys. Soc., Lond., and R. Met. Soc.* "*Meteorological factors in radio-wave propagation*," 215–38 (1947).—Experimental determination of the permittivity of steam for frequencies 3 000–20 000 Mc/s by resonant cavity methods indicate a slightly lower value than at frequencies < 58 Mc/s. The measured absorption agrees with theoretical estimates. The results have been used to assess absorption of radio waves by water vapour during propagation through the lower atmosphere. W. J. G. B.

537.226.08 : 621.317.73 1847

Simplified instrument for wide-range dielectric constant measurement. FISCHER, R. B. *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 35–7 (*Nov.*, 1947).—[Abstr. 1412 B (1948)].

537.226.092 : 539.89 = 82 1848

Measurement of the permittivity of ethylene under pressures up to 2 149 atmos. VERESHTAGIN, L. F., AND DUGINA, N. S. *C.R. Acad. Sci. URSS*, **58** (*No.* 1) 41–4 (1947) *In Russian*.—The experimental arrangement consisted of a coaxial cylindrical capacitor, gas filling the space between the inner brass and outer heavy steel earthed cylinder. The whole was immersed in a thermostatically-controlled oil bath. The gas was fed from a compressor via a manometer into the sealed capacitor; κ was measured at 2 Mc/s, and the results are plotted and discussed. It is confirmed that the Clausius–Mossotti function is constant with pressure and temperature. A. L.

537.226.1 = 3 1849

Improvement on the electrostatic method of measuring permittivity of gases. VAN ITTERBEEK, A., AND SPAEPEN, J. *Z. InstrumKde*, **63**, 167–9 (*May*, 1943) *In German*.—Describes an improvement on Verain's method [Abstr. 1557 (1915)]. The authors use a 3-electrode valve, and their improved apparatus is described in detail. The following permittivity values were found: 1·00054 for air at 760 mm Hg and 15°c; 1·00096 for O_2 at 776 mm Hg and 15·8°c. V. W. R.

537.228.4 : 621.383.6 1850

The use of a cavity oscillator for a Kerr electro-optical light shutter. LAPSLEY, A. C., SNODDY, L. B., AND BEAMS, J. W. *J. Appl. Phys.*, **19**, 111–12 (*Jan.*, 1948).—[Abstr. 1456 B (1948)].

537.228.5 : 535.332 *see Abstr.* 1807

ELECTRIC CURRENTS 537.3

537.311.3 : 538.222 1851

Some physical properties of solidified sodium-ammonia solutions. BIRCH, A. J., AND MACDONALD, D. K. C. *Trans. Faraday Soc.*, **43**, 792–9 (*Nov.–Dec.*, 1948). Thermometric, resistance and magnetic susceptibili measurements have been carried out on solidified sol tions of Na in liquid NH_3. The formation of a co centrated, highly conducting eutectic which can be supe cooled below its m.p. (−110°c) explains appare anomalies in electrical resistance. No evidence of supe conductivity or of anomalous magnetic properties w obtained.

537.311.3 : 539.16.08 : 548.0 185

On the mobility of electrons in pure non-polar insulator SEITZ, F. *Phys. Rev.*, 73, 549–64 (*March* 15, 1948).— It is shown that time-dependent perturbation theo can be validly applied to the determination of mobility diamond, Si and Ge and possibly non-polar insulati materials such as S. An expression is derived for th collision frequency for conduction electrons as a resu of collisions with the acoustical modes of oscillatio which is valid for diamond at room, and the other sub stances at lower, temperatures. With certain assump tions, the mobility in diamond at room temp. ≥ 156 cm²/volt-sec. It is shown that the mobilities c various insulators should have similar values in a rang of temps. where only the acoustical modes cause excita tion. The influence of non-acoustical modes in non-pola material is discussed. The implications for the proble of crystal counters are pointed out; mobility is probabl sufficiently large at room temp. in any non-polar crystal line insulator, but the concentration of trapping centre in a given specimen is probably the greatest limitation. A

537.311.4 = 3 185

The influence of adsorbing layers of dielectric materia molecules on the contact potential between two metals VON DUHN, J. H. *Ann. Phys., Lpz.* (*Folge* 5) **43** (*Nos* 1–2 37–52 (1943) *In German*.—To explain the small curren encountered when measuring conductivities of pur dielectric liquids, a theory was put forward that th electron emission work function was much smaller in th liquid than in vacuum and that the current was due t thermal electron emission. The difference in work function was ascribed to an adsorptive layer on th electrode, and the paper describes experiments on the change of work function when electrodes are subjected to dielectric liquid vapours. The contact potential of the metal covered with adsorbed molecules was measured against a standard electrode in a vacuum and found to be $\sim \pm 0{\cdot}8$ V. This is $\ll$ than the change in work function required to support the hypothesis. V. W. R.

537.312.5 : 535.371 1854

Electrical properties of incomplete phosphors. FRERICHS, R. *Research, Lond.*, **1**, 208–11 (*Feb.*, 1948).—The production of single crystals has enabled the photoconductivity of CdS to be studied. For voltage gradients of 1 000 V/cm there is a high peak for photoconductivity at about 5 200 Å at normal temp. which decreases in value and shifts to the red at higher temp. and increases with a shift to the violet at low temp. The dark current is very small. The effect decreases with frequency under intermittent illumination but is still appreciable at 10 kc/s. Apart from this selective effect there is a smaller photoconductivity of constant efficiency over the whole region of strong absorption (below 5 100 Å). Irradiation by wavelengths $> 8\,000$ Å quenches the photoconductivity somewhat. The photoconductivity effects are large and the crystals retain their sensitivity for many years; e.g. with a 10-W lamp focused by a 5–10 cm focus lens the resistance of a crystal of area $0{\cdot}2 \times 10$ mm decreased to 10 kΩ from many hundred MΩ with a field of 50 V/cm. Pre-

inary positive results have also been obtained with α-, β- and γ-rays and with CdTe and CdSe. J. E.

7.312.8 : 538.63 = 82 1855

Change of electrical resistance in a magnetic field for con-iron. DROZHINNA, V. I., AND SHUR, Y. S. *C.R. ad. Sci. URSS*, **58** (*No.* 6) 1017–18 (1947) *In Russian.*—e transverse and longitudinal magneto-resistance cts were measured at room temp. in 1% and 4% con iron. For the 4% specimen the effect was negative th in transverse and longitudinal fields; this disagrees h a prediction of Akulov that the effects should always ve opposite signs. A similar disagreement was found Bates [Abstr. 1344 (1946)] for permanent magnet oys. The 1% alloy had a positive effect for longi- linal and negative for transverse fields. D. S.

7.315 = 4 1856

The Volta effect. NADJAKOV, G. *C.R. Acad. Sci., ris*, **225**, 1134–5 (*Dec.* 10, 1947) *In French.*—The theory the method of measuring contact p.d. [Abstr. 1560 948)] is described. A. H. W. B.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

7.521 1857

Transients in Townsend discharges. NEWTON, R. R. *ys. Rev.*, **73**, 570–83 (*March* 15, 1948).—An analysis is ade of the transients in Townsend discharges for certain epwise variations in the stimulating photo-electric rrent from the cathode, while the voltage across the be is held steady. The method of analysis can be readily neralized to include any type of variation in the photo- ectric current. The steady-state current, including the fects of metastable molecules produced in the gas, is so derived; from this result it is shown that the second ownsend coefficient is a function of the electrode spacing. he work also suggests experiments which can separate ne radiation, ion and metastable contributions to the cond Townsend coefficient. A.

37.521.5 = 3 1858

The effect of convection on electric arcs. WEIZEL, W. *Phys.*, **122** (*Nos* 9–12) 620–35 (1944) *In German.*—an investigation of electrode-stabilized arcs when subject convection, i.e. arcs intermediate between those with mall electrode spacing and flame arcs. An accidentally isplaced arc straightens itself with a velocity depending n arc power, cross-section, curvature and temperature. f an arc is displaced by a gas stream or its own con- ection, its actual velocity is equal to the theoretical straightening" velocity without the gas stream or con- ection, and its curvature can be calculated. The stable lectrode-stabilized arc subject to convection suddenly nanges into a flame arc if the power per cm electrode pacing falls below a critical value. V. W. R.

537.521.7.029.6 : 621.3.015.5.029.6 1859

The microwave spark. POSIN, D. Q. *Phys. Rev.*, **73**, 496–509 (*March*, 1948).—Electrical breakdown of air was studied at wavelengths of 1·25 cm, 3 cm and 10 cm. Breakdown field strength was determined as a function of pressure, gap height, intensity of initial ionization, width of a single microwave pulse which sufficed for breakdown, and the pulse repetition frequency. It was found that the field strength for breakdown is strongly dependent upon the width of the microwave pulse, the intensity of initial ionization, and, of course, upon gap height and pressure of enclosed gas. A lesser dependence is found on the repetition rate of the pulses. The validity of Paschen's law at these high frequencies is investigated, and a semi-theoretical formulation of breakdown is obtained based on electron ionization competing with the process of electron attachment to neutral molecules (relatively immobile in the gas). A.

537.523.5 : 621.396.613 = 3 1860

Stability conditions and production of oscillations in arcs. ROMPE, R., AND WEIZEL, W. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 350–6 (1947) *In German.*—Describes the general elementary theory of production and sustenance of oscillations in circuits containing inductance and resistance with a discharge of voltage/current characteristic $U = U(I)$. The form of $U(I)$ in terms of the constants of the arc is then discussed. No direct comparisons with experiments are described. J. D. C.

537.525 = 3 1861

A new method for investigating gas-cleanup of glow discharges. MIERDEL, G. *Z. Phys.*, **122** (*Nos* 9–12) 614–19 (1944) *In German.*—Describes a method for measuring gas clean-up in rare gas glow discharges. The decrease in current due to increasing vacuum caused by clean-up is compensated by an external magnetic field parallel to the tube axis. The relation between gas pressure and magnetic field current is experimentally determined to obtain a calibration curve. Results with Ne and He in a glass tube with hollow cylindrical cathode are given. The authors found a good proportionality between tube current and rate of clean-up. V. W. R.

537.525 : 541.183 1862

Production of Joshi effect in air under electrical discharge: the rôle of sorbed chlorine. VENKATESWARA RAO, K. *Proc. Indian Acad. Sci. A*, **27**, 72–84 (*Jan.*, 1948).—The Joshi effect [Abstr. 2304 (1945)] in air, Cl_2, Cl_2-air mixtures, and air with sorbed Cl has been studied, and the results confirm the view that the effect originates in an adsorption-like boundary layer formed under discharge. W. R. A.

537.527.3 = 4 1863

Corona currents at high temperatures and pressures. Applicability of Paschen's law. PAUTHENIER, M., AND ROUSSE, J. *C.R. Acad. Sci., Paris*, **225**, 1293–4 (*Dec.* 22, 1947) *In French*—Describes briefly the determination of corona onset voltages in a coaxial wire/cylinder system up to 200°C and 6 atmos. pressure. The effect of wire radius (0·0015–0·015 cm) was also studied. Results are given in the form of empirical equations. J. D. C.

537.527.5 : 537.56 = 3 1864

Ionization and temperature in high-pressure electric arcs. SCHULZ, P., AND WEIZEL, W. *Z. Phys.*, **122** (*Nos* 9–12) 697–705 (1944) *In German*—In arc theory the Saha equation is used to find the connection between pressure, temperature and degree of ionization of the gas atoms. The equation is modified to include the effect of molecular rotation, oscillation, electron excitation and spin, which were previously neglected. The electron density of a high-pressure arc is deduced from the width of the spectral lines and the temperature found from Saha's equation and the new modified expression. The error by using Saha's equation is found to be about 500°K with temps. of ~ 8 000°K. V. W. R.

537.527.5 : 621.385.18 = 3 1865

The effect of convection on electrode-stabilised arcs. BUSZ, G., AND SCHULZ, P. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 7–8) 347–9 (1947) *In German.*—The various types of h.p. arcs are (*a*) wall stabilized discharges, (*b*) discharges controlled by convection, (*c*) discharges, with small interelectrode spacings, stabilized by electrode processes, and (*d*) discharges of type (*c*) but partly controlled also by thermal conduction. Types (*c*) and (*d*) are termed

"electrode stabilized arcs," and photographs of various modes in h.p. Xe are shown. J. D. C.

537.529 : 537.226 1866

The effect of trapping centers on dielectric breakdown in alkali halides. MEYER, C. F., AND HERMAN, R. C. *J. Chem. Phys.*, **16**, 161–6 (*March*, 1948).—The Seeger–Teller theory of dielectric breakdown [*Phys. Rev.*, **56**, 353 (1939)] for the alkali halides has been extended to account for the effect of trapping at low temperatures. The cross-section of ionized *F*-centres has been estimated classically, as well as from recent experiments on the photo-electric yield of *F'*-centres, to be $\sim 3\times10^{-13}$ cm² near liquid air temperatures. The increase in the breakdown field for NaCl is given as a function of the concentration of vacant halogen ion sites. An observable increase, of ~10%, in breakdown voltage is predicted at a concentration of 2×10^{18} centres per cm³. A.

537.533 : 778.34 : 771.534 = 3 *see Abstr.* 1972

537.533.7 = 4 1867

The rapid estimation of energy for electrons of medium and small velocity. TSIEN, S.-T., MARTY, C., AND DREYFUS, B. *J. Phys. Radium* (*Sér.* 8) **8**, 269–75 (*Sept.*, 1947) *In French.*—For energies < 50 keV, measurements with a cloud chamber showed a fixed ratio between the values of the range defined (*a*) by the r.m.s. distance between the beginning and end points of the track, and (*b*) by the length measured along the track itself (true range). A similar proportionality existed between the true range and the distance measured along a projection of the track in one plane. Use of these facts facilitates energy determination from observation of range. A. P. F.

537.533.73 : 539.13 *see Abstr.* 1886

537.533.73 : 539.232 *see Abstr.* 1919

537.533.74 : 539.232 *see Abstr.* 1920

537.534 : 621.384.6 1868

Development of the frequency modulated cyclotron. RICHARDSON, J. R., WRIGHT, B. T., LOFGREN, E. J., AND PETERS, B. *Phys. Rev.*, **73**, 424–36 (*March*, 1948).—[Abstr. 1459 B (1948)].

537.542 = 3 1869

On the resolving power of self-quenching counter tubes at high counting rates. BALDINGER, E., AND HUBER, P. *Helv. Phys. Acta*, **20** (*No.* 6) 470–5 (1947) *In German.*—The manner in which the output impulse and dead time of self-quenching counter tubes vary with the input impulse rate for different gas fillings were measured by a modified Stever method. The counting loss at high counting rates is then estimated. T. E.

537.56 1870

The ionization loss of energy of fast charged particles in gases and condensed bodies. HALPERN, O., AND HALL, H. *Phys. Rev.*, **73**, 477–86 (*March*, 1948).—The ionization loss of particles is treated, taking into account the polarization properties of the medium traversed. The medium is characterized by a general expression for a complex permittivity containing *n* different types of dispersion electrons, and one type of conduction electrons. Damping effects are not neglected but turn out to be significant for conduction electrons only. Formulae for the reduction in loss compared with the Bethe–Bloch expression for independent atoms, are derived and quantitatively discussed for the cases of physical interest. It is shown why qualitative and large quantitative differences occur in the results of the present multi-frequency theory compared with earlier work in which only a single dispersion frequency was assumed. Curves are given for a number of substances to show the reduction in energy loss for a wide range of momenta of the incident particles, the theory applying to all types of particles in the proper velocity range. A quantitative discussion is given which shows good agreement of the multifrequency theory with those experiments which at present allow quantitative evaluation.

537.56 : 537.527.5 = 3 *see Abstr.* 1864

537.568 : 535.343.4 *see Abstr.* 1810–11

537.581.5 : 530.145 *see Abstr.* 1770

COSMIC RAYS 537.591

537.591 187

Interaction of cosmic-ray primaries with sunlight and starlight. FEENBERG, E., AND PRIMAKOFF, H. *Phys. Rev.*, **73**, 449–69 (*March*, 1948).—This paper discusses collision processes between cosmic-ray primaries (protons and electrons) and the thermal photons of sunlight and starlight. In particular, electron-positron pair production and Compton scattering in interplanetary, intragalactic and intergalactic space are treated in detail. It is found that the number of collisions between primary particles and thermal photons in single traversals of the solar system and the local galaxy is not sufficiently large to cause either appreciable energy loss to the particles or appreciable production of secondary pairs and energetic scattered photons. The same statement holds for the primary protons even on an intergalactic scale. On the other hand, energetic primary electrons may experience a sufficient number of Compton collisions in intergalactic space (travel time $\sim 2\times10^9$ yr) to eliminate them effectively from the cosmic radiation reaching the neighbourhood of the earth. The stopping power for electrons of the observed interstellar r.f. spectrum is also estimated and found to be large.

537.591 : 523.11 *see Abstr.* 1738

537.591 : 523.165 *see Abstr.* 1740

537.591 : 537.123 : 530.12 *see Abstr.* 1765

537.591 : 539.18 *see Abstr.* 1913

537.591.8 : 539.185 : 539.17 = 4 *see Abstr.* 1909

MAGNETISM 538

538.214 : 542.952 = 4 187

Measurement of the magnetic susceptibility of vinyl acetate during polymerisation. TANAEVSKY, O. *C.R. Acad. Sci., Paris*, **225**, 1069–71 (*Dec.* 1, 1947) *In French.*—Variations in diamagnetic susceptibility with time of irradiation by ultra-violet light have been followed and from the data it is concluded that the polymerization reaction is of the second order and that the transformation of a double bond into two single bonds leads to an increase in susceptibility. W. R. A.

538.221 : 539.132 = 82 187

Oscillation of molecular magnets. ARKADIEV, W. K. *C.R. Acad. Sci. URSS*, **56** (*No.* 8) 803–5 (1947) *In Russian.*—It is pointed out that magnetic dispersion can be either of the relaxation or the resonance type. Some results of the author [Abstr. 417 (1927)] on Ni and on Birks on γFe_2O_3 [Abstr. 385 (1947)] show that the dispersion of cm-waves is of the resonance type. D. S.

538.222 = 82 187

Paramagnetic absorption in pentaphenylcyclopentadiani ($C_{35}H_{25}$). KOZUIREV, B. M., AND SALIKHOV, C. G. *C.R. Acad. Sci. URSS*, **58** (*No.* 6) 1023–6 (1947) *In Russian.*—Paramagnetic absorption has been measured at room temp. for $\lambda = 66$ cm and 5·85 m with steady magnetic fields of up to 400 gauss applied perpendicular to the oscillating field. The absorption has a maximum

a field H such that ν/H is the same for both frequencies d corresponds to a magnetic carrier with $g = 1{\cdot}95$. e absence of orbital magnetism agrees with static ceptibility measurements. D. S.

8.222 : 535.343–14 : 539.152.1 1875

The microwave spectroscopy of paramagnetic salts; the ectrum of chromic alum. Weiss, P. R. *Phys. Rev.*, **73**, 0–6 (*March*, 1948).—Some measurements on the sonance absorption of Cr alum are analysed for the rpose of obtaining a quantitative estimate of the litting of the lowest state of the chromic ion by the ectric field in the crystal. It is found that a small lindrical field in addition to the large cubic field present sufficient to account for the structure of the absorption rves, and that the magnitude of the splitting is $0{\cdot}15 \pm 01\ cm^{-1}$. It is pointed out that the methods used in is case can be applied to other similar salts such as Fe um and the hydrated Gd salts. A.

8.222 : 537.311.3 *see Abstr.* 1851

38.224 1876

Diamagnetic susceptibilities of magnesium and zinc ions. RASAD, M., Dharmatti, S. S., and Amin, H. V. *Proc. dian Acad. Sci. A*, **26**, 312–27 (*Nov.*, 1947).—Using a odified Gouy balance and KCl as standard reference ubstance, the susceptibilities of 12 Mg and 14 Zn solid alts, some inorganic and some organic, were measured. xperimental values are compared with calculated values. he empirical relationship between the susceptibility of lectronic isomers has been used to calculate the molecular usceptibilities of some of the compounds studied in this nvestigation. The results are also discussed graphically nd values for the ionic susceptibilities of Mg and Zn ons have been deduced. W. R. A.

38.23 1877

A mechanism of magnetic hysteresis in heterogeneous alloys. Stoner, E. C., and Wohlfarth, E. P. *Philos. Trans. A*, **240**, 599–642 (*May* 4, 1948).—Discusses the properties of a "model" in which exist particles of single domain size, for which change of magnetization takes place only by rotation of the magnetization vector. The behaviour depends on the anisotropy of the particle, which may arise from shape (because of different demagnetizing coefficients in different directions) or from lattice or strain effects. Effects of shape anisotropy of ellipsoids of revolution are treated in detail, and it is shown that for an oblate spheroid there is no hysteresis. In a prolate spheroid, estimates of equatorial diameter for the non-boundary-forming particles are $1{\cdot}5 - 6 \times 10^{-6}$ cm for Fe, $6 - 25 \times 10^{-6}$ for Ni. A discussion is given of the application of the theory to powder magnets, dispersion-hardening alloys and to effects of annealing in magnetic fields. Tables and curves give the results of calculations, and estimates are made of the contributions made to coercive force by the various forms of anisotropy; it is shown that for prolate spheroids of axis ratio $> 1{\cdot}1$ shape anisotropy effects will always dominate those from other causes. N. F. A.

538.24 = 3 1878

Large Barkhausen oscillations in wires traversed by a.c. and subjected to torsion. Koch, K. M. *Z. Phys.*, **122** (*Nos* 9–12) 706–13 (1944) *In German.*—If a.c. is passed through an Fe or Ni wire subjected to torsion and also to a gradually increasing longitudinal magnetic field, the longitudinal magnetization in the wire increases in large sudden steps in synchronism with the applied a.c. frequency. The effect is theoretically and experimentally investigated. It is thought that the circular magnetization due to torsion supplies the nuclei for the longitudinal magnetization, which uses up all the nuclei in a large sudden surge, so that these surges have the same frequency as the circularly magnetizing a.c. V. W. R.

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

538.534 : 621.3.011.3 1879

On Maxwell's method of geometrical mean distances. Zeitlin, L. A. *C.R. Acad. Sci., URSS*, **54** (*No.* 2) 135–6 (1946).—Using the result of a previous paper [Abstr. 1603 (1948)], the error introduced in using Maxwell's formula for the self-inductance of a plane circuit is calculated. L. S. G.

538.56 : 535.43 : 551.594.6 : 621.396.9 1880

The attenuation of radar echoes produced at centimetre wavelengths by various meteorological phenomena. Ryde, J. W. *Rep. Phys. Soc., Lond. and R. Met. Soc.* "*Meteorological factors in radio-wave progation*," 169–89 (1947).—[Abstr. 1588 B (1948)].

538.56 : 535.43 : 621.392.26 1881

Scattering of electromagnetic radiation by a thin circular ring in a circular wave-guide. Feuer, P., and Akeley, E. S. *J. Appl. Phys.*, **19**, 39–47 (*Jan.*, 1948).—[Abstr. 1495 B (1948)].

538.566 : 621.396.11 1882

On clinging of electromagnetic waves to a concave metal surface. Krasnooshkin, P. E., and Mustel, E. R. *C.R. Acad. Sci., URSS*, **54** (*No.* 3) 211–14 (1946).—Waves from a radiator near a concave surface are, under certain conditions, confined to a thin layer over the surface. This effect was investigated by using as radiator, a cylindrical tube, which ended in a conical horn. The clinging effect persists as the shape of the concave surface is smoothly varied, and occurs so long as the curvature of the surface does not change sign. But at an inflexion the wave separates from the wall and diffraction occurs. The theory of the clinging effect is developed; it compares favourably with the experimental results. L. S. G.

538.566.2 : 523.72 *see Abstr.* 1748

538.569.3 : 621.396.11 : 537.226.029.6 *see Abstr.* 1846

MAGNETIC EFFECTS 538.6

538.614 = 5 1883

The Kerr magneto-optic effect in non-ferromagnetic metals. Majorana, Q. *Nuovo Cim.*, **2**, 1–13 (*April*, 1944) *In Italian.*—Non-ferromagnetic metals are found to present the Kerr magneto-optic effect. This is in the opposite direction to that presented by ferromagnetic metals and about 1 000 times smaller. L. P.

538.63 : 537.312.8 = 82 *see Abstr.* 1855

538.652 = 82 1884

Magnetostriction of single crystals of silicon iron. Shturkin, D. A. *C.R. Acad. Sci., URSS*, **58** (*No.* 4) 581–2 (1947) *In Russian.*—The magnetostriction constants of monocrystalline 3·5% silicon iron were measured from 20°c to 600°c. At 20°c $\lambda_{100} \simeq 24 \times 10^{-6}$, $\lambda_{111} \simeq -2{\cdot}3 \times 10^{-6}$. With increase of temperature λ_{100} increases up to 480°c and then falls; the absolute value of λ_{111} decreases. D. S.

ATOMIC AND MOLECULAR STRUCTURE 539

539.11 : 549.514.51 : 535.32.096 *see Abstr.* 1800

539.13 : 535.35 : 551.594.5 1885

Active nitrogen. Kaplan, J. *Phys. Rev.*, **73**, 494–6 (*March* 1, 1947).—It is shown that Mitra's hypothesis which attributes the Lewis–Rayleigh afterglow of N to

the excitation of the molecules by a three-body collision, $N_2^+(X') + e + N_2 = N_2(B\text{-state}) + N_2(A\text{-state})$, cannot account for the spectrum of the auroral afterglow, in which there is incontrovertible evidence that ions in the $N_2^+(X')$ state are present. It is proposed that the most important reactions occurring in N afterglows and probably in polar auroras are the dissociative recombination, $N_2^+ + e = N' + N''$ (nitrogen atoms in metastable states), and collisions of the second kind involving very slow electrons and metastable atoms. A.

539.13 : 537.533.73 1886

The molecular structure of nitrogen dioxide. A re-investigation by electron diffraction. CLAESSON, S., DONOHUE, J., AND SCHOMAKER, V. *J. Chem. Phys.*, **16**, 207–10 (*March*, 1948).—An investigation of the structure of the NO_2 molecule has been made. The interpretation of electron diffraction photographs, which showed rings extending to values of q of nearly 100 ($q = 40/\lambda \sin \frac{1}{2}\theta$), leads to the structural parameter values: $N - O = 1{\cdot}20 \pm 0{\cdot}02$ Å, $O - N - O = 132 \pm 3°$. These values are discussed briefly and compared with those obtained by other methods. A.

539.132 1887

Force constants for some halomethanes. DECIUS, J. C. *J. Chem. Phys.*, **16**, 214–22 (*March*, 1948).—Valence-type force constants, including several interaction terms, have been deduced from some of the experimentally observed fundamental vibration frequencies of the molecular sequence CX_4, CX_3Y, CX_2Y_2, CXY_3, and CY_4 in which X may be Cl or Br, Y H or D. By assuming that the force constants are invariant for the different molecules and by neglecting several interaction constants associated with two bending motions, the number of distinct constants was reduced to 28, from which, after slight adjustment, 100 vibration frequencies were calculated. The quality of the fit with the experimental frequencies is indicated by a reasonably low root mean square deviation between calculation and observation (1·1% for 82 frequencies) and by the success of the constants in predicting 22 of the frequencies which were not used in the initial numerical evaluation of the constants. A.

539.132 1888

An asymptotic expression for the energy levels of the asymmetric rotor. II. Centrifugal distortion correction. GOLDEN, S. *J. Chem. Phys.*, **16**, 250–3 (*March*, 1948).—It has been found possible to develop perturbation operators for the centrifugal distortion terms that permit an approximate evaluation to be made of their contribution to the asymmetric rotor energy levels for large values of J. The procedure is based upon the asymptotic ($J \to \infty$) similarity between the matrices of the asymmetric rotor and that obtained from Mathieu's differential equation. A.

539.132 : 538.221 = 82 *see Abstr.* 1873

539.133 : 541.6 = 4 1889

Contribution to the study of polar moments. LUMBROSO, H. *C.R. Acad. Sci., Paris*, **225**, 1003–5 (*Nov.* 24, 1947) *In French.*—The dipole moments of the following are reported and are used in discussing their molecular structures: acenaphthene 1·6, anthracene 0, perylene 1·9–2, naphthacene 0, naphthacene-9 : 10-quinone 2·3, diketo-9 : 11- 3·4, and dichloro-9 : 11-naphthacene 2·5 D. W., R. A.

539.133 : 548.737 = 3 *see Abstr.* 1944

539.152.1 : 535.343–14 : 538.222 *see Abstr.* 1875

539.153 : 530.145 1890

The electromagnetic shift of energy levels. DYSON, F. J. *Phys. Rev.*, **73**, 617–26 (*March* 15, 1948).—The displacement between the $2s$ and $2p_{\frac{1}{2}}$ levels of H i calculated on the assumption that it is caused by inter action with the radiation field; the calculation is re lativistic, but the spin of the electron is neglected. Th theory gives a finite result, agreeing closely with th experimental value. [See Abstr. 3606, 3608 (1947)]. A

539.153 : 539.181 189

On the hyperfine structure of gallium. BECKER, G. E. AND KUSCH, P. *Phys. Rev.*, **73**, 584–91 (*March* 15, 1948) —The hyperfine structures of the ground $^2P_{\frac{1}{2}}$ and th metastable $^2P_{\frac{3}{2}}$ states of Ga^{69} and Ga^{71} have been deter mined by the atomic beam magnetic resonance method The h.f.s. levels for an atom whose nucleus has a magneti dipole, electric quadrupole, and magnetic octupol moment are given by the formula $W = aC/2 + bC(C+1) + c(C^3 + 4C^2 + 4C/5)$, where $C = F(F+1) - I(I+1) - J(J+1)$. For the metastable state of Ga with $I = J = \frac{3}{2}$, there are 4 levels at zero externa magnetic field, corresponding to $F = 3$, 2, 1, and 0 The determination of the separations of these level permits the calculation of the constants a, b, and c in the equation above. Only the first 2 terms are needed to explain the hyperfine splitting of each Ga isotope, within the precision of these measurements. An upper limit for the value of c is 3×10^{-9} cm^{-1}. Other results are: for Ga^{69}; a: $6{\cdot}3644 \times 10^{-3}$ cm^{-1} = $190{\cdot}790 \times 10^6$ sec^{-1}; b: $8{\cdot}6894 \times 10^{-5}$ cm^{-1} = $2{\cdot}6049 \times 10^6$ sec^{-1}; Q: $0{\cdot}186 \times 10^{-24}$ cm^2. For Ga^{71}; a: $8{\cdot}0868 \times 10^{-3}$ cm^{-1} = $242{\cdot}424 \times 10^6$ sec^{-1}; b: $5{\cdot}4759 \times 10^{-5}$ cm^{-1} = $1{\cdot}6416 \times 10^6$ sec^{-1}; Q: $0{\cdot}117 \times 10^{-24}$ cm^2. The $\Delta\nu$ of the normal state and the g_I of each isotope have been determined by the use of transitions in which $\Delta m_I = \pm 1$, $\Delta m_J = 0$ in the Paschen–Back region. For Ga^{69}: $\Delta\nu$: 0·089319 cm^{-1} = $2\,677{\cdot}56 \times 10^6$ sec^{-1}; g_I: − 0·0007239. For Ga^{71}; $\Delta\nu$: 0·113488 cm^{-1} = $3\,402{\cdot}09 \times 10^6$ sec^{-1}; g_I: − 0·0009218. The ratio $(\Delta\nu_{71}/\Delta\nu_{69}) = 1{\cdot}27059$ agrees well with $(a_{71}/a_{69}) = 1{\cdot}27063$. A.

539.154.2 = 3 1892

The extension of the periodic system through the trans-uranian elements. STARKE, K. *Naturwiss.*, **34** (*No.* 3) 69–75 (1947) *In German.*—A review of recent developments, with 4 tables and 66 references.

539.155 = 3 1893

Calculation of atomic weights. MEYER, S. *Acta Phys. Austriaca*, **1** (*No.* 2) 120–8 (1947) *In German.*—An empirical formula for calculating atomic weights is put forward. In an atom of mass number, M, containing in its nucleus N neutrons and Z protons, then $N - Z = J = M - 2Z$. The packing effect, $\Delta = a(M-1) - bJ^2$ has been computed using two sets of values for a and b. The computed values are compared with chemical and mass spectral data. W. R. A.

539.155.2 : 523.872 = 4 *see Abstr.* 1755

539.155.2 : 533.15.096 1894

The separation of the oxygen isotopes by thermal diffusion. LAUDER, I. *Trans. Faraday Soc.*, **43**, 620–30 (*Oct.*, 1947).—The constructions of a 1-stage and a 4-stage apparatus is described. The most efficient operating conditions have been determined. It is shown that the time required to reach a given concentration of heavy isotope in the 4-stage apparatus may be reduced considerably by starting the separation at a pressure above the optimum working pressure. Subsequently, as the separation progresses, the pressure is gradually decreased to the optimum working pressure. A simple system for producing a continuous flow of pure O_2 into the thermal diffusion apparatus at any desired rate and

ssure is described. By use of this flow system in nbination with the thermal diffusion apparatus, the ter which was electrolysed in the cell, was separated o a heavy fraction and a light fraction. The latter ction contained less heavy O_2 and less heavy H_2 than rmal water. Oxygen containing approximately 20% ^{8} has been isolated by operating the unit under the st suitable conditions for 15 weeks. A.

ADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

9.16.08 : 545.8 1895

Properties and measurement of carbon 14. REID, A. F., EIL, A. S., AND DUNNING, J. R. *Industr. Engng Chem. nalyt. Edit.*) **19**, 824–7 (*Nov.*, 1947).—This paper lists e properties of C^{14} important to measurement and gives detailed outline and examples of procedures and hniques for effective C^{14} analysis using a thin-idowed Geiger counter. β-ray absorption effects are cussed, as well as the systematic calibrations which ust be made when a counter system is used for tection. A.

9.16.08 : 545.8 = 4 1896

Analysis, without chemical treatment, of the amounts of and RdTh in a MsTh source. VICTOR, C.-P. *J. Phys. adium* (*Sér.* 8) **8**, 298–301 (*Oct.*, 1947) *In French.*—The ixed source is allowed to produce (γ, n) disintegrations Be and D respectively, the neutrons being used to tivate an Ag detector after being slowed down in raffin. Since MsTh γ-rays are too soft to produce oto-disintegration, and since the relative photo-utron yields from Ra and RdTh are different in Be and , an analysis is possible. A. P. F.

9.16.08 : 548.0 : 537.311.3 *see Abstr.* 1852

9.16.08 : 621.385.15 1897

Electron multiplier tube of large effective cathode rface area. FARAGÓ, P. S. *Nature, Lond.*, **161**, 60 *lan.* 10, 1948).—[Abstr. 1469 B (1948)].

9.163 1898

Natural radioactivity of rhenium. NALDRETT, S. N., ND LIBBY, W. F. *Phys. Rev.*, **73**, 487–93 (*March* 1, 1948). An attempt to confirm the reported *K*-capture activity Os^{187}, using OsO_4 mixed with A as the counter gas, led to reveal any activity corresponding to a $\frac{1}{2}$-life of 5×10^{11} yr. This method assumed that any *K*-capture Os would be followed by the emission of Auger ectrons which would be recorded. The sensitivity of he system to soft Auger electrons was demonstrated by sing 34·0-day A^{37} which decays by *K*-capture. Re was hen examined for β-activity, Re^{187} being isobaric with Os^{187}. An activity was found in two samples of different rigin which resisted chemical purifications. The $\frac{1}{2}$-life ppears to be $4\pm1\times10^{12}$ yr calculated for Re^{187} otope, and the range is 3·5 mg Al/cm^2 corresponding o an upper energy limit of $\sim$ 43 keV. A.

39.163.2 1899

Radiations from ^{27}Mg and ^{28}Al. BENEŠ, J., HEDGRAN, ., AND HOLE, N. *Ark. Mat. Astr. Fys.*, **35 A** (*Paper* 12) *pp.* (1948).—A magnetic lens spectrograph was used to tudy the β- and γ-radiations emitted by Mg^{27} and Al^{28}, ormed respectively by fast and slow neutron bombard-nent of Al^{27}. The γ-rays were studied by observing the ompton- and photo-electrons ejected from a Cu–Pb adiator. γ–γ coincidences also were investigated for Mg^{27}. Term-schemes are suggested for both disintegra-ions. A. P. F.

539.163.2 = 3 1900

Element 85 in the natural disintegration series. KARLIK, B., AND BERNERT, T. *Z. Phys.*, **123** (*Nos* 1–2) 51–72 (1944) *In German.*—A new α-activity of Ra A decay products was discovered and traced to an isotope 218 of element 85 from its energy and time-variation. Corresponding experiments with Th A and Ac A disclosed new series of α-rays apparently due to isotopes 216 and 215 of element 85. The results and energy balance of the processes are discussed, and the existence of isomeric Th C and Ac C nuclei is found probable. Repetition of experiments by Leigh-Smith and Minder [Abstr. 731 (1942)] on the existence of element 85 gave negative results. V. W. R.

539.163.2 = 3 1901

Radioactive decay of Zn^{63}. HUBER, O., MEDICUS, H., PREISWERK, P., AND STEFFEN, R. *Helv. Phys. Acta*, **20** (*No.* 6) 495–518 (1947) *In German.*—The particle and quantum radiations from Zn^{63} were exhaustively studied. Besides the annihilation radiation of the positrons, 3 less intense γ-rays were found. The softest of these (0·96 MeV) underwent appreciable internal conversion, in an amount corresponding to dipole radiation. The positron spectrum was analysed into 3 groups. Some Cu *K*-radiation was observed, showing that *K*-capture occurs in a small percentage of the transitions. A term scheme is presented. A. P. F.

539.163.2 = 4 1902

The absolute intensities of the radiations from V^{52}. BOUCHEZ, R., AND RENARD, G.-A. *J. Phys. Radium* (*Sér.* 8) **8**, 289–97 (*Oct.*, 1947) *In French.*—Absorption measurements, combined with β–β, β–γ and γ–γ coincidences, were used to study a soft β-ray found to be emitted in addition to the 2·7 MeV β-ray and 1·5 MeV γ-ray already known. It is ascribed to strong internal conversion of a γ-ray of $\sim$ 250 keV, produced in an isomeric transition from a metastable state of V^{52}. From the absolute intensity, formation of V^{52*} in about 20% of all $V^{51}(n,\gamma)$ processes is inferred. A. P. F.

539.163.2 : 539.165.2 1903

The beta-spectra of Cu^{64} as a test of the Fermi theory. COOK, C. S., AND LANGER, L. M. *Phys. Rev.*, **73**, 601–7 (*March* 15, 1948).—The momentum spectra of the negatrons and positrons emitted by Cu^{64} have been measured with high resolution under such conditions that the usual distortions resulting from source thickness and backing, scattering, and finite counter window are completely negligible for almost the entire range of energies. Whereas the Fermi theory predicts the correct distribution for the high energy region, it is found that there are more negatrons and positrons than are predicted by the theory at low energies. The shapes of the spectra and the fact that no nuclear γ-rays are observed preclude the possibility that they are complex spectra. Deviation from the Fermi theory occurs for energies $< 0{\cdot}270$ MeV for the positrons and 0·190 MeV for the negatrons. The end-point energies have been determined as $0{\cdot}657\pm0{\cdot}004$ MeV for the positrons and $0{\cdot}571\pm0{\cdot}002$ MeV for the negatrons. The ratio of the total number of electrons to positrons is 2·0. A.

539.163.2 : 539.172.1 *see Abstr.* 1910

539.164 : 778.33 *see Abstr.* 1973

539.165.2 = 4 1904

The general theory of electronic disintegrations. DAUDEL, R., JACQUES, R., JEAN, M., RATIER, J., AND BENOIST, P. *J. Phys. Radium* (*Sér.* 8) **8**, 257–62 (*Sept.*, 1947) *In French.*—The first of several articles discussing the various modes of disintegration—positron and

négatron emission, and orbital electron capture or creation. A. P. F.

539.165.2 : 539.163.2 *see Abstr.* 1903

539.165.2 : 539.172.13 : 539.167 = 3 *see Abstr.* 1908

539.166 1905

New experiments concerning the surplus gamma-radiation from rocks. Hess, V. F., and Roll, J. D. *Phys. Rev.*, **73**, 592–5 (*March* 15, 1948).—See Abstr. 3638 (1947). The same activity was observed from granite in an underground station as at sea level; thus the surplus radiation cannot be due to artificial radioactivity induced by cosmic rays. The significance of the new value for the intensity and absorption of K^{40} γ-rays [Abstr. 182 (1948)] is pointed out. A.

539.166 1906

Gamma-radiation from granite. Urry, W. D. *Phys. Rev.*, **73**, 596–601 (*March* 15, 1948).—The ionization of a granite sample was doubled by adding U, Th and K in amounts equal to the content of these three elements in the granite. Thus the activity is accounted for by the measured U, Th and K content and the previously reported discrepancy [Abstr. 3638 (1947)] must be due to error in calculating the expected ionization. A.

539.166 : 535.5 1907

Angular correlation of scattered annihilation radiation. Snyder, H. S., Pasternack, S., and Hornbostel, J. *Phys. Rev.*, **73**, 440–8 (*March* 1, 1948).—If the two photons emitted in an annihilation process are scattered, their initial cross-polarization leads to an angular correlation of the scattered radiation. This correlation effect is calculated, and yields a substantial azimuthal asymmetry. It is shown that one may regard the scattering of one photon as performing a partial analysis of the polarization of the other photon. A.

539.167 : 539.172.13 : 539.165.2 = 3 1908

Activity in magnesium produced by deuterons and the question of *K*-capture in Na^{22}. Bothe, W. *Z. Phys.*, **123** (*Nos* 1–2) 1–9 (1944) *In German.*—Na^{22}, Na^{24} and Mg^{27} were produced by the deuteron bombardment of Mg. The excitation curves and effective cross-section for deuterons up to about 7 MeV were determined and results are discussed. Indirect and direct experiments were made to investigate *K*-capture in Na^{22} as theoretically predicted by Lamb [*Phys. Rev.*, **50**, 388 (1936)]. The results show that *K*-capture of Na^{22}, if it occurs at all, is of a very much smaller magnitude than theoretically calculated. V. W. R.

539.17 : 523.877 = 4 *see Abstr.* 1758

539.17 : 539.185 : 537.591.8 = 4 1909

Some nuclear phenomena of cosmic origin observed at sea-level. Cüer, P., and Morand, M. *C.R. Acad. Sci., Paris*, **225**, 1146–8 (*Dec.* 10, 1947) *In French.*—Some photographic plates were exposed for a year and then examined. Plates loaded with B showed a density of (Li + He) tracks corresponding to a thermal neutron flux of $\sim 0{\cdot}1/cm^2/min$. Fast protons from outside the emulsion and neutron-produced proton recoils starting in the emulsion were also observed. The estimated fast neutron flux was $\sim 0{\cdot}03/cm^2/min$. A. P. F.

539.172 : 539.18 *see Abstr.* 1914

539.172.1 : 539.163.2 1910

Threshold for the proton-neutron reaction in copper. Shoupp, W. E., Jennings, B., and Jones, W. *Phys. Rev.*, **73**, 421–3 (*March* 1, 1948).—The direct determination of the (p, n) threshold for Cu^{65} has been found. The energy of the $Li^7(p, n)$ threshold had been previously checked against the $F(p, \gamma)$ resonances, and the value, $1{\cdot}85 \pm 0{\cdot}01$ MeV, of this threshold of Li^7 was used as the voltage standard. The value for the $Cu^{65}(p, n)$ threshold was found to be $2{\cdot}164 \pm 0{\cdot}01$ MeV. If the mass of Cu^{65} is taken as 64·955, the mass for Zn^{65} is computed to be $64{\cdot}9565 \pm 0.001$. If after positron emission the resultant nucleus is in the ground state, the max. energy of the positron spectrum may be computed to be $0{\cdot}355 \pm 0{\cdot}001$.

539.172.13 : 539.165.2 : 539.167 = 3 *see Abstr.* 1908

539.172.3 : 539.185 *see Abstr.* 1917

539.172.4 = 3 191

Resonances in the process $S^{32}(n, p)P^{32}$. Bleuler, E. *Helv. Phys. Acta*, **20** (*No.* 6) 519–24 (1947) *In German.*—Using monochromatic neutrons of various energies obtained from the D + D reaction with a thin target, the P^{32} activity induced in S was studied as a function of neutron energy between 2 and 3·7 MeV. Resonances were found at 2·80, 3·10, 3·46 and 3·65–3·7 MeV. A. P.

539.172.4 = 3 191

Resonance processes for fast neutrons on N^{14} and S^3 Stebler, A., and Huber, P. *Helv. Phys. Acta*, **21** (*No.* 59–86 (1948) *In German.*—Pulse-size distributions for th $N(n, \alpha)$, $N(n, p)$ and $S(n, \alpha)$ reactions were measure using a pressure ionization chamber containing N_2 SO_2. Bombardment with neutrons of a single energy le to a knowledge of the heats of reaction. Then, usin D + D neutrons partially slowed down in graphite, th energy levels of the compound nuclei N^{15} and S^{33} wer investigated. The (n, p) and (n, α) peaks in the pulse size distribution were distinguished by their differen variations with ionization chamber pressure, due to wa effect. A level scheme for N^{15} is given. A. P.

539.18 : 537.591 191

Disintegration of positive and negative mesotrons different absorbers. Nereson, N. *Phys. Rev.*, **73**, 565– (*March* 15, 1948).—the β-decay of positive and negati mesotrons has been studied in the case of B, C, Al, an Fe absorbers. Positive mesotrons showed a deca process in all four, while negative mesotrons indicate decay phenomena (having mean lifetimes $> \sim 0{\cdot}6$ μse in only the B and C absorbers. Results are in agreemer with other similar experiments of this type, showing th for negative mesotrons decay phenomena predominate i absorbers of small atomic number and capture processe in absorbers of large atomic number.

539.18 : 539.172 191

The negative meson and its mass. Lukirsky, P. I., an Perfilov, N. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 219–22 (1946).—A study is made of the nuclear captu of negative mesons. The probability of capture is larg for slow non-ionizing mesons, and capture leads to th disintegration of the nucleus with the production of star in a cloud chamber or photo-emulsion. Ninetee disintegrations were studied, the nuclear reactions bein of 4 types:—

$$\mu^- + N^{14} \rightarrow 2\,He^4 + 2\,H^1 + 4n_0$$
$$\mu^- + O^{16} \rightarrow 3\,He^4 + H^1 + 3n_0$$
$$\mu^- + N^{14} \rightarrow He^4 + 4\,H^1 + 6n_0$$
$$\mu^- + O^{16} \rightarrow 2\,He^4 + 3\,H^1 + 5n_0$$

The masses of the negative mesons, in the 19 case studied, were found to be either about 140 or 200 electro masses, no intermediate values being recorded. L. S. C

539.181 : 539.153 *see Abstr.* 1891

539.185 191

Neutron cross sections of the elements. Goldsmith H. H., Ibser, H. W., and Feld, B. T. *Rev. Mod. Phys*

259–97 (*Oct.*, 1947).—A comprehensive collection of most reliable experimental results so far available, sented in the form of graphs of cross-section *v.* energy, ether with a general descriptive text. In general, two ves are given for each element; the division is at 1 keV the energy scale, this representing approximately the ndary between low and high energy techniques.
A. P. F.

.185 1916
Note on the Milne problem for a sphere. BERLIN, T. H. *vs. Rev.*, **73**, 437–40 (*March* 1, 1948).—A formal solution the Milne problem for the sphere is presented which nbits the shadow of the sphere and the corresponding continuity in the neutron distribution function. Two iting cases leading to the Milne problem for the plane briefly discussed. A.

).185 : 537.591.8 : 539.17 = 4 *see Abstr.* 1909

).185 : 539.172.3 1917
Yields of neutrons from photo-neutron sources. RUSSELL, SACHS, D., WATTENBERG, A., AND FIELDS, R. *Phys. v.*, **73**, 545–9 (*March* 15, 1948).—The number of utrons emitted per sec per curie from 10 photo-utron sources were determined, and are listed. The oto-disintegration cross-section for deuterium, $\sigma_D(\gamma,n)$, found to be 16×10^{-28} cm² at 2·76 MeV. / $\sigma_{Be}(\gamma,n)$ is und to be 7×10^{-28} cm² at 2·76 MeV, and $>9\cdot7\times10^{-28}$ cm² at 1·67 MeV. The more reliable ratios of $\sigma_{Be}(\gamma,n)/\sigma_D(\gamma,n)$ are 0·43 at 2·76 MeV and 0·30 at 50 MeV. The curve of $\sigma_{Be}(\gamma,n)$ *v.* energy must pass rough at least one max. and one min. in the range 63–2·76 MeV. The number of 2·7-MeV photons per sintegration of Mn^{56} is estimated to be ~1%. These ıotons are probably due to direct transitions to the ound state from the known excited levels of Fe^{56}. A.

39.185 : 778.33 *see Abstr.* 1974

STRUCTURE OF SOLIDS 539.2

39.2 : 535.51 : 535.39 *see Abstr.* 1823

39.217.5 1918
Solution and diffusion in high polymers. CARPENTER, . S. *Trans. Faraday Soc.*, **43**, 529–38 (*Aug.–Sept.*, 947).—A method is described for determining the olubility and diffusion coefficient of a gas in a high olymer, based on the mathematical relationships efining the rate of absorption of solute by an immobile olvent specimen of simple shape, consequent upon a nange of surface concentration. Experimental results re given for the solubility and diffusion coefficient of I_2, O_2 and H_2 in a soft-vulcanized natural rubber at emperatures between 25° and 50°C. A.

39.232 : 537.533.73 1919
Oxide films formed on titanium, zirconium, and their lloys with nickel, copper, and cobalt. An electron iffraction study. HICKMAN, J. W., AND GULBRANSEN, . A. *Analyt. Chem.*, **20**, 158–65 (*Feb.*, 1948).

39.232 : 537.533.74 1920
Structure of anodic films formed on aluminium in xygen gas discharge. DANKOV, P. D., AND IGNATOV,). V. *C.R. Acad. Sci., URSS*, **54** (*No.* 3) 235–8 (1946).—The preparation of the films is briefly described and esults are reported concerning electron diffraction atterns of unoxidized and oxidized surfaces. The eflection patterns of an unoxidized surface showed the alf-rings typical of the face-centred lattice of cubic Al rystals, but after anodic oxidation for 10–20 min the attern of Al disappeared. The transmission patterns f non-oxidized films gave a pattern free of fog, typical of Al, but the patterns of oxidized specimens showed all lines of Al and also a diffuse ring. L. S. G.

539.264 : 536.421.1 1921
An X-ray study of the stepwise melting of anhydrous sodium palmitate. NORDSIECK, H., ROSEVEAR, F. B., AND FERGUSON, R. H. *J. Chem. Phys.*, **16**, 175–80 (*March*, 1948).

539.264 : 666 1922
X-ray studies of alkali chlorides dissolved in B_2O_3–glass. MAJUMDAR, S. K., AND BANERJEE, B. K. *Indian J. Phys.*, **30**, 222–232 (*Oct.*, 1947).—X-ray investigation was made of $NaCl–B_2O_3$, $KCl–B_2O_3$ and $RbCl–B_2O_3$ glass systems and the effect of different concentrations of alkali chloride in B_2O_3 glass. It is found that alkali chloride retains its characteristic structure and in some cases induces crystallinity in the glass itself. A.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.32 : 539.374 *see Abstr.* 1925–7

539.37 : 539.62 1923
Internal friction in engineering materials. ROBERTSON, J. M., AND YORGIADIS, A. J. *J. Appl. Mech.*, **13**, *A*173–82 (*Sept.*, 1946).—A comprehensive review of previous work on internal friction is followed by some experimental measurements on various metallic and plastic materials. It is concluded that, in a cyclic phenomenon, damping capacity is independent of the frequency, but $\propto$ (stress amplitude)³. A good bibliography is provided. G. O. B.

539.374 1924
A theory of the yielding and plastic flow of anisotropic metals. HILL, R. *Proc. Roy. Soc. A*, **193**, 281–97 (*May* 27, 1948).—A theory is suggested which describes, on a macroscopic scale, the yielding and plastic flow of an anisotropic metal. The type of anisotropy considered is that resulting from preferred orientation. A yield criterion is postulated on general grounds which is similar in form to the Huber–Mises criterion for isotropic metals, but which contains six parameters specifying the state of anisotropy. By using von Mises' concept of a plastic potential, associated relations are then found between the stress and strain-increment tensors. The theory is applied to experiments of Körber and Hoff on the necking under uniaxial tension of thin strips cut from rolled sheet. It is shown, in full agreement with experimental data, that there are generally two equally possible necking directions whose orientation depends on the angle between the strip axis and the rolling direction. As a second example, pure torsion of a thin-walled cylinder is analysed. With increasing twist anisotropy is developed. In accordance with recent observations by Swift [*Engineering*, **163**, 253 (*April* 4, 1947)], the theory predicts changes in length of the cylinder. The theory is also applied to determine the earing positions in cups deep-drawn from rolled sheet. A.

539.374 : 532.5 *see Abstr.* 1781

539.374 : 539.32 1925
The visco-elastic behaviour of cordite. I. Plastic flow in compression at high stresses. ELEY, D. D., AND PEPPER, D. C. *Trans. Faraday Soc.*, **43**, 559–68 (*Aug.–Sept.*, 1947).—The rate of plastic flow in compression, ϕ, has been examined over the temperature range 17–70°C, and the stress range 6–161 kg.cm^{-2}. At low stresses, i.e. below a certain stress f_0 (which is a function of temperature), the dependence of ϕ upon f is of the form to be expected from Eyring's theory of flow, namely, $\ln\phi = \text{const.} + bf$, where b is a constant. At higher stresses, $f > f_0$, it is found that $\phi = A(f - f_0)$ where A is a constant, inde-

pendent of stress, and a function of temperature. On certain assumptions a "viscosity coefficient" in poises may be calculated from A. This result at high stresses is not easily reconcilable with Eyring's theory. Whether the deficiency lies in the theory of flow, or the model to which the theory is applied, must be left an open question at present. A.

539.374 : 539.32 1926

The visco-elastic behaviour of cordite. II. The plastic and elastic extension of cords at low stresses. ELEY, D. D., AND PEPPER, D. C. *Trans. Faraday Soc.*, **43**, 568–83 (*Aug.–Sept.*, 1947).—The total extension of cordite in the range 2·6–5·2 kg/cm² and 20–78°C is the sum of rapid elastic, delayed elastic and plastic components, with marked thermal hysteresis effect. The first probably involves orientation of short chain segments of nitrocellulose. The second also involves orientation, and though its modulus is little influenced by stress, temp. and thermal pre-treatment, the rate of development is markedly affected, particularly by strain, as is the third component. These two components, and cord rupture, are shown to be activated processes; the activation energy lies in the range 30 ± 10 kcal, at a stress of 4·4 kg/cm². A.

539.374 : 539.32 19

The visco-elastic behaviour of cordite. III. T plastic and elastic torsion of cords at low stresses. EL D. D., AND PEPPER, D. C. *Trans. Faraday Soc.*, 4 583–91 (*Aug.–Sept.*, 1947).—The torsion of cords cordite has been analysed into rapid elastic, delay elastic and plastic components. The derived elas moduli at room temperature agree with those obtained extension. At higher temperatures there is a divergen probably due to anisotropy. The time course of delay elastic flow, and plastic flow, is similar to that obser in extension, and the rate constants obtained are general agreement. The torsional method confirms t effect of applied stress upon the delayed elastic deform tion. This is probably primarily an effect on the rate deformation, but experimental difficulties have prevent an evaluation of moduli at different stresses. It has be shown that the hardening during continued plastic fl is not solely a function of strain, but also involves tim The further problems associated with the field of wo have been discussed.

539.62 : 539.37 *see Abstr.* 1923

539.89 : 537.226.092 = 82 *see Abstr.* 1848

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.124/.128

541.126 : 536.46 1928

The limits of flame propagation at atmospheric pressure. I. The influence of "promoters." EGERTON, A., AND POWLING, J. *Proc. Roy. Soc. A*, **193**, 172–90 (*May* 27, 1948).

541.126 : 536.46 1929

The limits of flame propagation at atmospheric pressure. II. The influence of changes in the physical properties. EGERTON, A., AND POWLING, J. *Proc. Roy. Soc. A*, **193**, 190–209 (*May* 27, 1948).

541.126 : 536.71 1930

The hydrodynamic theory of detonation. II. On absolute calculations for condensed explosives. PATERSON, S. *Research, Lond.*, **1**, 221–33 (*Feb.*, 1948).—[See Abstr. 436 (1948)]. The hydrodynamic theory of detonation is used, in conjunction with a virial type equation of state for gases at high pressures and temperatures, to calculate the large-scale properties of the detonation wave in perfectly confined solid and liquid explosives yielding entirely gaseous products. The theory is extended to cover cases where the products are partly condensed, and applied to a representative series of commercial blasting explosives. Satisfactory agreement is found in each case with the experimental velocities of detonation in well-confined cartridges. A.

541.128.5 : 541.183.5 *see Abstr.* 1936

ELECTROCHEMISTRY 541.13

541.13 : 621.357.7 = 4 1931

Electrolytic deposition of ThB and ThC on various metals. COCHE, A. *C.R. Acad. Sci., Paris*, **225**, 936–9 (*Nov.* 17, 1947) *In French.*—The critical potentials for deposition on Ag, Au, Cu, Pt and Ta, using very dilute solutions, were found by studying the collected β-activities. The ThB was in $0{\cdot}6\times10^{-10}$ N solution, and the ThC $0{\cdot}7\times10^{-13}$ N. Deviations from normal behaviour were found for both on Ta and Pt. A. P. F.

541.133 19

Electrode reactions in alternating fields. III. T dynamic capacitance. BREYER, B., AND GUTMANN, *Trans. Faraday Soc.*, **43**, 789–91 (*Nov.–Dec.*, 1947).—T capacitance changes at a reversibly depolarized electro in an alternating field have been investigated theoretical and experimentally. Quantitative expressions have be derived for the "dynamic capacitance" due to the no linear current/voltage relationship at such an electrod and it has been shown that the capacitance reaches a ma at the standard potential. Its origin is to be found charge-transfers within the ion atmosphere participatir in the electrochemical process.

COLLOIDS . DISPERSE SYSTEMS . 541.18/.18

541.182 : 532.613 193

Apparent anomalies in the surface- and interfacia tension-concentration curves of aqueous solutions paraffin-chain salts. REICHENBERG, D. *Trans. Farada Soc.*, **43**, 467–79 (*Aug.–Sept.*, 1947).—A discussion given of the surface- and interfacial-tension-concentratio curves of soap solutions. It is shown that minima in thes curves are not to be expected if the materials used are pur and that therefore the minima found experimentally mus be due to impurities. Assuming the impurities to be salt of polyvalent ions present in the water used, the theor explains why the minimum occurs at the critical cor centration of the soap, and why a maximum is also show sometimes. Such experimental data as are availabl appear to support the theory put forward. A

ADSORPTION 541.183

541.183 : 531.19 193

Statistical mechanics of multimolecular adsorption IV. The statistical analog of the BET constant a_1b_2/b_1a_2 Hindered rotation of a symmetrical diatomic molecul near a surface. HILL, T. L. *J. Chem. Phys.*, **16**, 181– (*March*, 1948).—[See Abstr. 768 (1948)]. An approxi mate study is made of the restricted rotation of a sym

ical diatomic molecule near a surface. This makes ible some calculations concerning the BET constant $= R\exp(\varepsilon_1 - \Lambda)/kT$, and especially the factor R, ch do not support a suggestion of Cassie [Abstr. 3111 5)]. An alternative method of estimating the area upied per molecule in a completely filled monolayer nentioned. A brief discussion of the temperature-endence of the quantity R as predicted by the present roximate treatment is included. A.

183 : 537.525 *see Abstr.* 1862

183.2 1935

Multimolecular absorption. II. CASSIE, A. B. D. *ns. Faraday Soc.*, **43**, 615–20 (*Oct.*, 1947).—For I, see tr. 3111 (1945). It is shown that the multimolecular orption isotherm proposed by Brunauer, Emmett and ler is only applicable to systems where absorption urs as distinct clusters of molecules; it is not applicable multimolecular absorption as continuous layers super-ed on a continuous monolayer. Some effects of face energies in multimolecular absorption are dis-sed, and it is shown that the water repellency of keratin ot inconsistent with its absorption of water vapour. A.

.183.5 : 541.128.5 1936

Poisoning of platinum catalysts at high temperatures. VAGE, R. H. *J. Chem. Phys.*, **16**, 237–40 (*March*, 48).—Poisoning films of exceptional thermal stability formed on a Pt catalyst when heated in a silicone pour (hexamethyldisiloxane) at pressures of the order $^{-3}$ mm. These films prevent the combination of H d O at low pressures and are not removed until heated about 1 440°K in the presence of H (or to higher mperatures in O). It is suggested that the film may nsist of a silicon oxide oriented with the Si atoms ached directly to the Pt and presenting an outer layer O atoms, effectively shielding the catalyst. A.

CHEMICAL STRUCTURE 541.4/.6

1.6 : 539.133 = 4 *see Abstr.* 1889

1.63 : 548.737 *see Abstr.* 1945

CHEMICAL PROCESSES 542.9

542.9 : 535.338 = 4 1937

On a reaction mechanism involving the free radicals C_2, CH and OH. PANNETIER, G., AND GAYDON, A. G. *C.R. Acad. Sci., Paris*, **225**, 1300–2 (*Dec.* 22, 1947) *In French.*—When H_2 or H_2O is added to a flame of dry C_2N_2 the spectrum shows bands of CH, OH and NH, while C_2 and CN are weakened. Reactions of the excited radicals are discussed. A. G. G.

542.952 : 538.214 = 4 *see Abstr.* 1872

CHEMICAL ANALYSIS 543/545

543.81 : 621.317.39 1938

Moisture testing of baled straw by electronic methods. WILSON, N. F. *Paper Tr. J.*, **126**, *TAPPI Sect.*, 35–6 (*Jan.* 15, 1948).—[Abstr. 1400 B (1948)].

545.7 : 621.317.39 : 533.275 *see Abstr.* 1787

545.8 1939

Techniques in the use of carbon 14. DAUBEN, W. G., REID, J. C., AND YANKWICH, P. E. *Industr. Engng Chem. (Analyt. Edit.)* **19**, 828–32 (*Nov.*, 1947).—A method is described for the incorporation of isotopic CO_2 into organic compounds by the Grignard reaction. The yields obtained vary from 80 to 95%, based on CO_2. A detailed description is given for the conversion of organic substance into a form suitable for radioactivity determination and the construction and use of equipment employed to determine relative radioactivity of such samples. A.

545.8 : 539.16.08 *see Abstr.* 1895

545.8 : 539.16.08 = 4 *see Abstr.* 1896

545.82 1940

Note on quantitative spectral analysis of solutions available in very small quantities only. EWLES, J., AND CURRY, C. *Proc. Leeds Phil. Lit. Soc.*, **4**, 299–302 (*Dec.*, 1946).—Two methods are described for obtaining spark spectrograms of solutions, using quantities of the order of 0·1 cm³. Graphs of measurements for Ca concentrations in solution in the range 0·01–0·04 g /100 cm³ are given to illustrate the applicability of the methods. C. C.

CRYSTALLOGRAPHY 548

48.0 : 539.16.08 : 537.311.3 *see Abstr.* 1852

48.24 : 548.5 = 4 1941

Twins and crystallogenetic disequilibrium. DEICHA, G. *Experientia*, **4** (*No.* 2) 67–8 (1948) *In French.*—By supersaturation of NaCl solutions it is possible to produce wins with [110] in common, but the plane of twinning (100) for one member and (111) for the other. A. J. C. W.

48.5 : 548.24 = 4 *see Abstr.* 1941

48.736.42 = 3 1942

Crystal structure of Sc(OH)3. SCHUBERT, K., AND EITZ, A. *Z. Naturforsch.*, **2a**, 535 (*Sept.*, 1947) *In German.*—Cubic, $a = 7{\cdot}88_2$ [kx ?], space group Im3, 8 Sc in (c), 24 OH in (g) with $y = 0{\cdot}30_7$, $z = 0{\cdot}18_2$. The crystals are pseudo-holohedral because of micro-twinning. A. J. C. W.

48.736.452 = 3 1943

The crystal structure of barium uranate. Non-existence of the UO_4 group. SAMSON, S., AND SILLÉN, L. G. *Ark. Mat. Astr. Fys.*, **25 A** (*Paper* 21) 16 *pp.* (1947) *In German.*—$BaUO_4$ is orthorhombic, space group Pbcm, $a = 5{\cdot}751$, $b = 8{\cdot}135$, $c = 8{\cdot}236$ Å, all $\pm 0{\cdot}005$ Å, the cell containing 4 formula units. The Ba and U atoms were located by means of a Patterson projection and the O atoms by packing considerations guided by the general agreement of observed and calculated intensities. Each U is surrounded by six O's in a distorted octahedron, four of the O's being shared with neighbouring U's to form a network $\perp$ to a. The nets are held together by layers of Ba++ ions. There are thus no $UO_4^{=}$ ions in the structure, which accounts for its insolubility. Powder and Weissenberg photograph data are given. A. J. C. W.

548.737 : 539.133 = 3 1944

The valency angle of the oxygen atom in diphenyl ether. PLIETH, K. *Z. Naturforsch.*, **2a**, 409–10 (*July*, 1947) *In German.*—*pp'*-di-iodo-diphenyl ether is monoclinic, $a = 5{\cdot}84$, $b = 28{\cdot}14$, $c = 9{\cdot}84$ Å, $\beta = 52°$, with 4 molecules/unit cell. The positions of the I atoms were determined, and from the observed distance between the I atoms belonging to one molecule and the assumed values of the I–C, C–C and C–O interatomic distances the valency angle of the O atom was found to be $123 \pm 2°$.

Reasons for its difference from the 118 ± 3° obtained by electron diffraction are discussed. A. J. C. W.

548.737 : 541.63 1945

Study of cyclo-octatetraene. KAUFMAN, H. S., FANKUCHEN, I., AND MARK, H. *Nature, Lond.*, **161**, 165 (*Jan.* 31, 1948).—The "tub" form, with alternating double and single bonds (length 1·34, 1·54 Å resp.; C=C—C angle, 125°) is shown to be the only one whi will fit experimental data.

MINERALOGY 549

549.514.51 : 539.11 : 535.32.096 *see Abstr.* 1800

GEOPHYSICS 55

550.34 : 551.461 = 4 *see Abstr.* 1947

550.341 : 534.21 1946

Internal waves in certain types of density distribution. GROEN, P. *Nature, Lond.*, **161**, 92 (*Jan.* 17, 1948).

550.37 : 551.594.1 *see Abstr.* 1958

550.385 : 621.396.11 : 551.510.535 = 82 *see Abstr.* 1952

551.461 : 550.34 = 4 1947

Several aspects of terrestrial structure clarified by seismology. ROTHÉ, J.-P. *Rev. Sci., Paris*, **85**, 401–8 (*April* 15, 1947) *In French.*—Velocities of Love waves show that the Pacific floor is in the sima, and that this ocean is an original feature of the earth's surface. The Atlantic east of the Wyville-Thompson Ridge is revealed as continental in character, whilst west of it the wave-velocities reveal a floor of Pacific type, i.e. of sima. Whilst the Mediterranean geosyncline and Eurafrican structures do not cross the ridge. The data support the view that east of the ridge there is a sunken continent, and west of it an original oceanic basin. W. A. R.

ATMOSPHERE . METEOROLOGY 551.5

551.510.5 : 551.557 = 4 1948

Height of base of the free atmosphere. ROULLEAU, J. *C.R. Acad. Sci., Paris*, **225**, 813–14 (*Nov.* 3, 1947) *In French.*—Four thousand pilot balloon ascents at Tours 1925–35 were classified according to wind speed at various heights, and separated into morning (8 a.m.), evening (5 p.m.) and night ascents. Mean values were obtained for wind speed in 100 m steps in height. All occasions with frontal changes in the previous 24 hours were omitted. The geostrophic wind was taken as the level where direction does not change with height and the speed varies with height according to the classical equation. The height for the free atmosphere was found to vary with wind speed and greatly with the hour of the day. R. S. R.

551.510.535 : 525.721 : 621.396.11 = 4 1949

Ionospheric observations during the total eclipse of 20 May, 1947. DENISSE, J.-F., SELIGMANN, P., AND GALLET, R. *C.R. Acad. Sci., Paris*, **225**, 1169–71 (*Dec.* 10, 1947) *In French.*—Curves are given of the variations of critical frequency for the E, F_1 and F_2 layers and of the absorption of the D layer at 4 Mc/s for 2 hr. on either side of totality. The respective recombination coefficients are $0{\cdot}5\times10^{-8}$, 2×10^{-9}, 10^{-10} and 10^{-7}. A. HU.

551.510.535 : 621.396.11 = 82 1950

The absorption of short radio waves in the ionosphere and the electrical field potential at the reception site. KAZANTSEV, A. N. *Bull. Acad. Sci. URSS, Dep. Tech. Sci.* (*No.* 9) 1107–38 (1947) *In Russian.*—[Abstr. 1518 B (1948)].

551.510.535 : 621.396.11 = 82 1951

Long range prognosis of critical frequencies of, and disturbance in, the ionosphere. BARTENEV, G. M. *Bull. Acad. Sci. URSS, Dep. Tech. Sci.* (*No.* 9) 1139–52 (1947) *In Russian.*—The correlation between the 11-year cyc of critical frequencies and the ionospheric and magnet disturbances, and the Wolf-numbers is investigate The 5 different time cycles of ionosphere conditions—1 1 and ½ yr (spring-autumn maxima), season and 27 da are described. Statistical methods of interpretation ar prediction are discussed critically, and linear and no linear regression methods analysed and their practic application demonstrated. A.

551.510.535 : 621.396.11 : 550.385 = 82 195

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551.515.08 : 621.396.9 195

Radar storm detection. I. WESTWATER, F. L. **II.** ROS R. G. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteor logical factors in radio-wave propagation*," 190–3 (1947).— Brief notes on some observations of rainstorms and clouc with radar equipment. W. J. G. I

551.521.11 : 628.92 195

Duration and intensity of sunshine. BENFORD, F *Illum. Engng, N.Y.*, **62**, 527–44 (*May*); 877–89 (*Nov.* 1947).—[Abstr. 1616 B (1948)].

551.524.4 : 551.571.4 : 621.396.11 195

The structure and refractive index of the lower atmo sphere. SHEPPARD, P. A. *Rep. Phys. Soc., Lond. an R. Met. Soc.*, "*Meteorological factors in radio-wav propagation*," 37–79 (1947).—A review of data on th vertical distribution of temperature and humidity in th bottom km of the atmosphere with particular referenc to variations in refractive index for h.f. radio waves Diurnal and seasonal variations in temperature an humidity for air over land and sea are examined in detail Meteorological conditions leading to a strong refractiv index lapse are considered. W. J. G. B

551.524.4 : 551.571.4 : 521.396.11 195

A method for deducing the refractive-index profile of stratified atmosphere from radio observations. MAC FARLANE, G. G. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 250–2 (1947).—It is shown that the profile of refractiv index of a stratified atmosphere can be obtained eithe from one set of radio height-gain measurements at a fixe range from a sender and a few measurements of fiel strength at a constant height, or from two sets of height gain measurements each at a different wavelength. Only measurements of amplitude, and not of phase, of the fiel strength are required. It is suggested that the refractiv index profile obtained solely from radio observations may represent a better average for use in predicting fiel strengths on different wavelengths than one obtaine from a single meteorological sounding. W. J. G. B

557 : 551.510.5 = 4 *see Abstr.* 1948

571.4 : 621.396.11 : 551.524.4 *see Abstr.* 1955–6

576 : 551.594.2 = 4 *see Abstr.* 1959

576.1 : 621.396.11 : 621.396.9 : 551.594.6 *see Abstr.* 1962

58 : 621.396.11 : 551.594.6 *see Abstr.* 1963

593.5 : 535.43 1957

vestigation of the atmosphere by means of a search-beam to altitudes of up to 55 km. MIKHAILIN, L. M., KHVOSTIKOV, I. A. *C.R. Acad. Sci. URSS*, **54** (*No.* 23–5 (1946).—The previous "ceiling" of 34 km in investigation of the atmosphere by a searchlight beam, been extended to 55 km by utilizing the difference in night sky brightness in various zones of the spectrum. range 4 500–5 500 Å is well suited for taking photo-hs of the beam with the night sky as background. scattering capacity of the air at various heights was rmined, there being an inversion between 25 and m. Density and temperature values of the atmo-ere up to altitudes of 5 km may be determined from a obtained with a searchlight beam. L. S. G.

593.5 : 535.88 : 535.341 = 4 *see Abstr.* 1809

593.9 : 535.7 *see Abstr.* 1829

593.9 : 551.594.5 : 535.33 = 4 *see Abstr.* 1801

594.1 : 550.37 1958

urrents of atmospheric electricity. CHALMERS, J. A., LITTLE, E. W. R. *Terr. Mag. Atmos. Elect.*, **52**, –60 (*June*, 1947).—The charge conveyed to a test tray rying a layer of earth with ordinary grass growth ed on top of a roof is stored in a capacitor and the lting discharge current recorded at regular intervals means of a high-sensitivity ballistic galvanometer. parallel, current measurements are made by means of oint-discharge recorder. The test results obtained ing a period of 10 months are analysed with respect the total charge collected, the magnitude of the duction current, the point-discharge current, the ct of rain, both during long periods and short showers, nderstorms, snow and sleet, hail, and fog. Particular ups of simultaneous records obtained are discussed l enable a comparison to be made between the various ording methods used. A definite relation is found to t between conduction currents and point discharge. s concluded that, in England, a small negative balance ts of the current flowing to earth. R. H. G.

594.2 : 551.576 = 4 1959

On the electric field in and around cumulus clouds. COLAZET, R. *C.R. Acad. Sci., Paris*, **225**, 1085–6 ec. 1, 1947) *In French.*—A glider carrying an electro-ter was released above the clouds and the fields countered in its downward glide registered. A typical t result is reproduced, and it is stated that the electric d increases rapidly at and below heights of ~ 5 000 ft. e field reaches a maximum in the centre of the cloud falls steeply below cloud level. A max. field strength ~ 90 V/m is indicated. R. H. G.

594.221 = 3 1960

On the velocity of the electric current flow in the return oke of a lightning discharge. WALTER, B. *Ann. Phys.*, z. (*Folge* 6) **1** (*Nos* 1–3) 65–8 (1947) *In German.*—From alitative assumptions regarding the presence of a large duced charge in the ground at the point about to be uck and regarding the sudden collapse of the potential ference across the subsequent return stroke channel, s channel is claimed to represent an unstable discharge cuit. This instability condition is stated to be re-ablished every time a component stroke occurs in a multiple-stroke flash. It is recognized that these assumptions are opposed to Schonland's ideas of the origin of multiple discharges and several phenomena are quoted to support the suggested new picture; e.g. the great velocities of return strokes, the occurrence of multiple discharges from single cloud centres, and the occasional variations of the discharge paths of successive strokes in a multiple flash. R. H. G.

551.594.221 = 3 1961

On several peculiarities in the leader and return processes of lightning discharges. WALTER, B. *Ann. Phys., Lpz.* (*Folge* 6) **1** (*Nos* 1–3) 69–74 (1947) *In German.*—Starting from the established conceptions of the neutralization effected by the return stroke both along the main channel and along any branches, a lightning photograph previously described in 1903 but not reproduced here is re-examined. The very unequal luminosities of the leader and return strokes in two branches of the photograph are explained by the large charge supplied during the leader process to a third branch situated between the foregoing two branches. The same fact is said to explain the absence of an increased luminosity of the centre branch during the return process. R. H. G.

551.594.5 : 535.35 : 539.13 *see Abstr.* 1885

551.594.5 : 551.593.9 : 535.33 = 4 *see Abstr.* 1801

551.594.6 : 535.43 : 621.396.9 : 538.56 *see Abstr.* 1880

551.594.6 : 551.576.1 : 621.396.11 : 621.396.9 1962

Meteorological investigations in connection with radio propagation. JOHNSON, N. K. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 212–15 (1947).—A brief review of the investigation of meteorological conditions influencing radio propagation; discussion of vertical gradient of temperature and humidity, non-homogeneity of the atmosphere and use of radar in investigating structure of cumulo-nimbus clouds. W. J. G. B.

551.594.6 : 551.58 : 621.396.11 1963

Radio climatology. DURST, C. S. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 193–211 (1947).—Meteorological conditions of temperature and humidity are examined for certain regions of the globe in certain seasons. These conditions are related to the occurrence of abnormal refraction of radio waves. From this examination it is shown how the regions of abnormal refraction can be mapped for much of the world provided maps are available of (*a*) the contrast of sea and air temperature, (*b*) humidity, (*c*) horizontal air flow near the surface, and (*d*) vertical air flow at a low height. A.

551.594.6 : 621.396.11 1964

The influence of tropospheric conditions on ultra-short-wave propagation. APPLETON, E. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 1–17 (1947).—[Abstr. 1519 B (1948)].

551.594.6 : 621.396.11 1965

An experimental study of the effect of meteorological conditions upon the propagation of centimetric radio waves. SMITH-ROSE, R. L., AND STICKLAND, A. C. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 18–37 (1947).—[Abstr. 1520 B (1948)].

551.594.6 : 621.396.11 1966

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551.594.6 : 621.396.11 1967

A standard radio atmosphere for microwave propagation. BEST, A. C. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorological factors in radio-wave propagation*," 267–73 (1947).—[Abstr. 1522 B (1948)].

551.594.6 : 621.396.11 1968

Note on errors in measurement of the refractive index of the air for high-frequency radio waves consequent upon errors in meteorological measurements. BULL, G. *Rep. Phys. Soc., Lond. and R. Met. Soc.*, "*Meteorologi factors in radio-wave propagation*," 273–8 (1947).

551.594.6 : 621.396.821 19

Distant localization of individual atmospherics with cathode-ray direction-finder of unidirectional type. STO REGEN, W. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 26) 14 (1947).—[Abstr. 1581 B (1948)].

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612.84 : 53.088.21 1970

Blinking: its role in physical measurements. LAWSON, R. W. *Nature, Lond.*, **161**, 154–7 (*Jan.* 31, 1948).

612.84 : 621.397 1971

The sensitivity performance of the human eye on an absolute scale. ROSE, A. *J. Opt. Soc. Amer.*, **38**, 196–208 (*Feb.*, 1948).—An absolute scale of performance is set up in terms of the performance of an ideal picture pickup device, that is, one limited only by random fluctuations in the primary photo process. Only one parameter, the quantum efficiency of the primary photo process, locates position on this scale. The characteristic equation for the performance of an ideal device has the form $BC^2\alpha^2$ = constant (B = luminance of the scene, C = threshold contrast, α = angular size of a test object in the scene). This ideal type of performance is shown to be satisfied by a simple experimental television pickup arrangement. By means of the arrangement, two parameters, storage time of the eye and threshold signal-to-noise ratio are determined to be 0·2 sec and 5 respective Published data on the performance of the eye are co pared with ideal performance. In the ranges of B(10⁻ 10² footlamberts), C(2–100%) and α(2′–100′), the p formance of the eye may be matched by an ideal dev having a quantum efficiency of 5% at low lights a 0·5% at high lights. This is of considerable techni importance in simplifying the analysis of problems volving comparisons of the performance of the eye a man-made devices. To the extent that independe measurements of the quantum efficiency of the eye c firm the values (0·5% to 5·0%), the performance of eye is limited by fluctuations in the primary photo proce To the same extent, other mechanisms for describing eye that do not take these fluctuations into account ruled out. It is argued that the phenomenon of da adaptation can be ascribed only in small part to primary photo-process and must be mainly controlled a variable gain mechanism located between the prima photo-process and the nerve fibres carrying pulses the brain.

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666 : 539.264 *see Abstr.* 1922

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771.534 : 778.34 : 537.533 = 3 1972

Electron sensitivity of various photographic emulsions. NISSEN, H. F. *Z. Phys.*, **122** (*Nos* 5–8) 573–88 (1944) *In German.*—The effect of electron beams in an electron microscope on various AgBr emulsions was studied. The sensitivity increases with larger grain, while the gradient of the blackening-illumination S-curve decreases. Various emulsions are compared and should be selected for minimum required electron-beam illumination and according to the absorbing properties of the object itself. Sensitizing or desensitizing is ineffective for electron beams. Plates are superior to films for electron microscope photography. V. W. R.

778.33 : 539.164 1973

Surface radiography with alpha rays. JECH, Č. *Nature, Lond.*, **161**, 314 (*Feb.* 28, 1948).—Objects (butterfly wing, wood surfaces) were exposed to Rd for 2 hrs and then placed on a photographic plate for 8 min. Images showing the surface structure were formed.

778.33 : 539.185 19

Neutron radiography. KALLMANN, H. *Researc Lond.*, **1**, 254–60 (*March*, 1948).—A number of metho of registering neutrons photographically are develop and used for neutron radiography. The electron emissi from Ga, Ag, and In is used in one method and the emission from Cd is used in another, but the prefer method involves the use of Li or B, the α-particles fr which impinge on a fluorescent screen in contact with photographic film. It is claimed that by the use of t technique the blackening per neutron is comparable w that per X-ray quantum in the usual X-ray metho Neutron radiographs are reproduced. J.

778.33 : 621.385.16 19

Pinhole radiography of magnetrons. DUNSMUIR, MILNER, C. J., AND SPAYNE, A. J. *Nature, Lond.*, 1 244–5 (*Feb.* 14, 1948).—[Abstr. 1470 B (1948)].

778.34 : 537.533 : 771.534 = 3 *see Abstr.* 1972

778.53 : 536.46 : 535.33.072 *see Abstr.* 1804